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by

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DEDICATION

To the memory of my beloved parents

To my family
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ABSTRACT

The Saudi Arabian Stock Market went through several changes since the substantial increase of oil prices in 1973. This study firstly analyses the impact of oil revenue in developing the market and shaping its major characteristics. Secondly, it examines the effect of oil prices fluctuation and other macroeconomic variables as a determinant of stock return over the period between 1991 and 2000.

The main empirical findings indicate that the market risk premium is the most important factor in determining stock return. The influence of oil prices fluctuation over and above the market premium was explicit in firms belonging to subsidised sectors such as electricity and agriculture.

The impact of other economic variables varies among different firms listed in the market. Exchange rate has a significant effect on the banking firms while other variables have limited impact over and above the market on various companies, indicating that the effect of these variables are captured by market index. The results of empirical analysis become more explicit when replacing the market premium factor with market timing risk. In general, study suggests that under the current circumstances, the market premium is the most appropriate measure in determining the return in the Saudi Stock Market.
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ABBREVIATIONS

ADF Augmented Dickey-Fuller
APT Arbitrage Pricing Theory
ARIMA Auto Regressive Integrated Moving Average
CAPM Capital Asset Pricing Model
CML Capital Market Line
CPI Consumer Price Index
CTU Central Trading Unit
EMF Emerging Markets Fact book
EMH Efficient Market Hypothesis
ESIS Electronic Share Information System
G.C.C. Gulf Cooperation Council
GDP Gross Domestic Product
GNP Gross National Product
IAIGC Inter-Arab Investment Guarantee Corporation
LR Likelihood Ratio
MENA Middle East and North Africa
NYSE New York Stock Exchange
OLS Ordinary Least Square
OPEC Organization of the Petroleum Exporting Countries
SAMA Saudi Monetary Agency
SML Security Market Line
SR Saudi Riyal
SSRC Saudi Shares Registration Company
VAR Vector Auto-Regression
CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION

The main aim of this thesis is to evaluate the performance of the Saudi stock market through applied econometric analysis, and investigate the determinants of return, specially the impact of oil on stock returns for Saudi stocks. The Saudi Arabian economy has undergone radical changes in its structure since the boom of oil prices in 1973 which resulted in a substantial increase in Saudi oil revenues. The massive increase in wealth had to be channelled into investment to further the development of the country and for distribution to the public. This was achieved by establishing a large number of companies and then offering their shares partially or fully to the public; this included the Saudization (nationalisation) of foreign banks.

The role of oil in transforming the Saudi economy is not only restricted to its macroeconomic structure, but to the market as well; it has played an important role in the emergence and the development of the Saudi stock market and has important implications for the performance of the market.

The market was established formally in 1984. However, the history of Saudi stock market goes back to the 1970s when the number of joint stock companies increased considerably. The enormous amount of wealth accumulated following the boom of oil prices in 1970s was needed for investment and distribution. For these
purposes, the Saudi government used the joint stock companies. The market witnessed in the following years significant improvements in structure, trading systems and objectives of the Saudi stock market. By the year 2000, the market reached a market capitalization of nearly $67 billion and became the largest stock market in the region. However, since the Saudi Arabian economy is oil-based economy, oil has important implications for the determination of returns in the stock market; while a high oil price results in higher profits for oil related industries, it reduces the performance of firms in other industries. Increase of oil revenues gives a chance for the government to subsidise various sectors resulting in higher performance in the economy. On the other hand, macroeconomic factors play an important role in determining the performance of a stock market. In light of the above, investigating the performance of the stock market and its relation to the performance of the economy as a whole seems an interesting subject.

In the finance literature, two important models of stock market pricing are widely used in empirical analysis of the performance of stock markets, namely the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Model (APT). The capital asset pricing theory states that the market risk of a given stock can be measured by its tendency to move with the general market. This tendency is reflected in its beta coefficient. The CAPM states that the systematic risk is the only factor that determines return on asset. If investors are able to eliminate unsystematic risk through diversification, then there is no need to compensate for bearing it. Stocks that have higher beta are expected to give higher return or higher losses because they are riskier than the lower beta stock. The CAPM predicts that a security’s rate of return will be linearly related to a single common factor. That is the rate of return on the market. On
the other hand, the arbitrage pricing theory assumes that the rate of return on a stock is a linear function of $K$ factors that reflect economic forces. Each of the economic forces represents a fundamental source of non-diversifiable risk. APT gives no information about the number and content of factors. In the literature, many macroeconomic variables are related to stock prices such as risk factors in the APT framework, and most of them show a significant relationship.

To this end, our research has focused on the role of oil and other macroeconomic factors in the process of price formation in the Saudi stock market. We will use an econometric analysis of data for the Saudi Stock market over the period from 1991 to 2000 and make use of data disaggregated by industries and firms. This will allow us to understand the behaviour of the Saudi stocks and to see if the unexpected change in macroeconomics variables, especially oil, is priced in the market portfolio or it has an independent effect on sectors’ and firms’ returns. The analysis will show us the applicability of CAPM and APT in Saudi stock market. In this respect, our research can be considered as an examination and evaluation of the market’s performance.
1.2 SCOPE AND OBJECTIVES

The Saudi stock market differs from other markets in several aspects. Financial markets are built to allocate funds from savers in order to be invested in a productive way that benefits the economy. In the case of Saudi Arabia, we found that the market was developed as a response to a substantial increase in oil revenues and has been used as a tool for distributing income among the public. This has led to closing the market to foreign investors and limiting trading to Saudi citizens. This study tries to analyse the major characteristics of the Saudi stock market and apply the stock pricing models in order to identify the determinant of Saudi stock return and to examine the extent to which fluctuations in oil prices and other economic variables influence that return.

Capital asset pricing model (CAPM) is applied to assess the risk return relationship in the Saudi stock market. The determinants of market return based on the estimation of the APT model are also applied to shed light on some of the important features of the determinants of market return and the role of macroeconomic variables in the process.
1.3 THE SIGNIFICANCE OF THE STUDY

Several studies related to the Saudi stock market have been conducted. Most of them are related to market efficiency or the financial reports of the companies. However, the impact of macroeconomic variables in determining stock return is not widely studied. Although changes in the macroeconomic structure are considered to be the major force behind establishing the Saudi market, other changes in the environment, such as the collapse of the Kuwait stock market in 1982, played a vital role in shaping the market structure.

This study is significant in two aspects. Firstly, it employs financial modelling using data covering the period from 1990 to 2000. Share prices during this period were collected through the Electronic Share Information System (ESIS), which gives more reliable data in contrast to the data before 1990. Secondly, it gives a detailed historical and managerial analysis of the market to provide more insight to the interpretation of the empirical results. Furthermore, stationary test was carried for all variables in order to avoid spurious regression.
1.4 OUTLINE OF THE THESIS

The thesis aims to investigate the determinants of return in the Saudi Stock market, through applied econometric analysis. Its central theme is that the explicit account of information on oil prices in an empirical analysis of stock market’s returns provides a better understanding of price determination in the market. This will improve the explanatory power of the empirical analysis and provide economic insights on the role of oil in generally understanding the economic performance of Saudi Arabia.

The remaining part of the thesis is organised into six chapters:

Chapter 2 presents an overview of the Saudi economy with concentration on the role of oil in the economy. A detailed managerial analysis and the main economic indicators of stock market performance at an aggregate and disaggregate level are presented as well.

Chapter 3 provides a review of theoretical and empirical literature on asset pricing. There, we present theoretical underpinnings of CAPM and APT which are the main models of the financial markets. Thereafter, we provide a critical review of the empirical literature on the relationship between macroeconomic variables and stock return. Theoretical and empirical issues arising from such studies are also discussed.

Chapter 4 subjects the data to empirical analysis. A preliminary analysis of the data and models employed in chapters five and six shall be provided too. This includes
definition and calculation of the surprise variables, descriptive statistics and time
series properties of these variables.

The empirical work of the thesis is provided in the next two chapters. Chapter 5
investigates empirically the risk-return relationship using the CAPM model making
use of the data over the period 1990-2000. The relationship was assessed through the
regression coefficient, which was generated by regressing asset return on market
index return. Chapter 6 evaluates the impact of unexpected changes in oil prices and
in other macroeconomic variables on the excess return of firms listed in the Saudi
stock market in the arbitrage pricing theory framework.

Chapter 7 concludes our study.
2.1 INTRODUCTION

It is widely acknowledged that the level of economic performance of a country is closely related to the performance of its stock market. This is due to the fact that stock markets as the most important part of the financial markets perform a number of economic functions. These functions are: (1) to provide funds for long-term projects; (2) to let company owners liquidise cash out their physical assets; (3) to finance illiquid physical assets by using liquid assets to re-trade existing ownership. Of course, it is vitally important that the design and organisation of the stock markets and the structure of the economy within which the stock markets work, allow these functions to operate properly. In this chapter, therefore, we provide detailed information on the structure of the Saudi economy and the Saudi stock market and its basic components.

The Saudi economy can be characterised as an oil-based economy with its 261 billion barrels of proven recoverable crude oil reserves representing about one-quarter of world oil reserves. Oil accounts for more than 90% of the country's exports and nearly 75% of government revenues. While the Saudi economy enjoyed a substantial surplus in its trade and achieved very high growth rates in the 1970's due to a sharp rise in petroleum revenues, major falls in oil revenues in the 1980s resulted in
budgetary deficits and poor economic performance. In recent years, Saudi Arabia has established the Supreme Economic Council to formulate and improve coordinate economic development policies in order to accelerate economic reform. Although the Saudi government has partly succeeded in developing industry and agriculture significantly, heavy dependence on petroleum revenue continues and unemployment remains a problem.

The history of the Saudi stock market goes back to the 1970s when the number of joint stock companies increased considerably in response to the increase in oil prices. However, it operated informally until its legal framework was established in 1984. The following years witnessed significant improvements in its structure and trading system. By the year 2000, the Saudi Stock market reached a market capitalization of nearly $67 billion becoming the largest stock market in the region. However, in many ways, it still resembles an underdeveloped market: Saudi citizens only can participate in the market; it has no independent regulatory authority; only a limited number of companies are listed on the market. These and other characteristics of the stock market will be discussed below.

In the remaining part of this chapter, first, the main economic indicators of the Saudi economy will be presented. Then, we will discuss the structure of the Saudi stock market in order to understand how it functions. This will give an insight into an analysis of market behaviour. In what follows, Section 2.2 provides a discussion on the main economic indicators of the Saudi economy while section 2.3 provides a detailed overview of the market. Specifically, we shall consider the historical
development, organisational structure, operational structure and the major characteristics of the market. Section 2.4 concludes.
2.2 THE MAIN ECONOMIC INDICATORS

An evaluation of the performance and development of the Saudi stock market cannot be completed without understanding the structure of the Saudi Arabian economy. For this reason, in this section, we provide a brief overview of Saudi macroeconomic experiences between 1970 and 2000.

The planned development efforts to transform oil based economy into that of a modern industrial state began in 1970 when the first development plans were launched. While the first two plans covering 1970s were focused on infrastructure investment, in the third plan (1980-1985), the emphasis changed to investment in education, health and social services. The targets of the first three plans were largely completed with the help of the massive oil revenues earned in this period. The number of public companies also increased substantially in this period.

As a result, the structure of the Saudi economy changed substantially in the period from 1970 to 2000: the role of the private sector, especially in non-oil sectors, increased considerably and the sectoral composition of the economy shifted from the oil sector to industry and agricultural sectors. However, in the period from 1990 to 2000, the economy faced several challenges such as the Gulf War and the drop in oil prices which resulted in depletion of the country’s reserves and increased debt. Nevertheless, the oil sector still plays a dominant role in the economy. Of course, the change in the structure of the economy has important implication for the Saudi stock market.
In the rest of this section, we provide a brief overview of macroeconomic indicators of the Saudi economy. We first look at changes in the gross domestic product, GDP, of Saudi Arabia in the period from 1990 to 2000. Then, we examine the changes in the structure of the economy and reform programme.
2.2.1 Gross Domestic Product

In the last three decades, Saudi GDP and GDP per capita passed through three stages. The first stage was when the price of oil increased massively. In this stage, the real Saudi GDP between 1970 and 1974 rose at an average growth rate of 24.1 percent per annum. However, over the period 1975-1980 it declined to 6.8 percent per annum. The GDP per capita increased from 5082 SR in 1971 to 56642 SR in 1980. The end of this period witnessed the completion of infrastructure investment (highways, power generation, sea ports).

In the second stage, when spending on infrastructure declined significantly, investment in education, health, and social services increased considerably. The real GDP grew by 6.5 and 4.7 percent in 1980 and 1981 respectively. However, massive declines in oil revenues in 1982 and the following year forced the government to finance its expenditure from reserves at the beginning and with debt in the later stages. Starting from 1982, the rate of growth of GDP was virtually negative and increasing budget deficits forced the Saudi government to cut off public investment expenditure and slow down economic activities. GDP per capita dropped from 61177 in 1981 to 27837 in 1990.

The third stage witnessed the dramatic events of the second Gulf War, which started in 1990-1991, and the down turn of oil prices which occurred from 1993 to 1995. These two major events put further pressure on the government which slowed economic activities. Growth in the Saudi economy fell from 9.13 to 4.6 percent in 1991 and 1992 respectively. This growth was related to government expenditure on
the Gulf War. In 1993 no growth was achieved. In 1994 it reached only 0.7 percent and between 1995 and 2000 it achieved a 2.1 percent growth per annum on average. Table 2.1 presents the contribution of various sectors to Saudi GDP over the period from 1990 to 2000. The GDP of Saudi Arabia consists of two major parts: mining of crude oil and natural gas, and non oil sector. It is known that Saudi Arabia has about 261 billion barrels of proven recoverable crude oil, and more are discovered than produced every year. Also, the estimated natural gas reserves in Saudi Arabia are approximately 5.1 trillion cubic meters representing 35% of the worlds known reserves. Crude petroleum and gas comprise 36% of total GDP on average (Figure 2.1).

The non oil sector is divided into two parts: private sector and government sector. The private sector's contribution of GDP in the 1990s varies from one sector to another. While some sectors have improved others declined. The agriculture, forestry and fishing contributions to GDP declined from 6.02% in 1990 to 5.68% and stayed around this figure for the rest of the decade. However, the agriculture sector was aided significantly by government subsidies and suffered when government spending declined in the early 90s. The manufacturing sector, other than oil refining, however, improved significantly as its percentage of GDP jumped from 4.79% in 1990 to 7.45% in 2000. Some sectors, like electricity, transport, post and communication fluctuated in a very narrow margin around the same level over the 1990s. The construction sector declined in 1993-1994 then started to pick up again. As the government role in the economy reduced, the construction industry has been increasingly depending on the private sector and quasi-government companies. The restaurants and hotels sector seems to be a promising sector. Since 1996 it has
achieved steady improvement; its percentage of GDP increased from 6.16% in 1996 to 7.62% in the year 2000. Finance, insurance, real-estate and the business services sector contributed 14.15% in 1990. After the Gulf War started, this declined to reach 11.51 in 1998 but it has slightly improved in the years 1999 and 2000.

The government sector’s contribution to the GDP comprised 25% on average over the period 1990-2000.

### Table 2.1: Gross Domestic Product by Type of Economic Activity (Million Riyals)

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<td>Less: Imputed Bank Services Charge</td>
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<td>Producers of Govt. Services</td>
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<td>593,955</td>
<td>623,237</td>
</tr>
<tr>
<td>Import Duties</td>
<td>7,881</td>
<td>7,179</td>
<td>9,899</td>
<td>9,842</td>
<td>8,649</td>
<td>7,603</td>
<td>8,883</td>
<td>8,940</td>
<td>9,987</td>
<td>9,634</td>
<td>9,714</td>
</tr>
<tr>
<td>Gross Domestic Product (GDP)</td>
<td>484,106</td>
<td>528,178</td>
<td>552,625</td>
<td>552,769</td>
<td>556,448</td>
<td>557,566</td>
<td>576,433</td>
<td>591,378</td>
<td>608,141</td>
<td>603,589</td>
<td>632,951</td>
</tr>
</tbody>
</table>

Source: Saudi Monetary Agency (SAMA)
Figure 2.1: Percentage Distribution of Gross Domestic Product by Oil and Non-Oil Sectors in K.S.A.

2.2.2 Economic Structure

*Export*

Historically, oil export receipts have accounted for the bulk of total export revenues despite government endeavours to diversify the country’s export base. Figure 2.2 shows that oil, as a percentage of total exports, was 90.7 in year 1990. As a result of oil price increases during the Gulf War, this percentage increased to 91.43 and 92.52 in 1991 and 1992 respectively. However, when the price of oil started to decline between 1993 and 1995, its percentage in total exports decreased to 87.02%. In the year 1996, the percentage improved slightly but fell to 84.23% in 1998 when oil prices sank below 10 dollars a barrel. As the price improved in the year 2000, the percentage rose up again to reach 91.46. The share of such oil related industries, as chemicals and plastics amounted to 5% of total exports (Table 2.2). This percentage increase depends on oil prices; when oil prices declined in 1998, the percentage of chemicals and plastics rose to 9.5%. Food stuff, electrical and other exports only totalled about 4% of total exports. Re-export commodities came to about 1%.
### Figure 2.2: Percentage of Oil in Total Exports

[Bar chart showing the percentage of oil in total exports from 1990 to 2000.]

*Source: SAMA.*

### Table 2.2: Composition of Exports (Million Riyals)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Mineral Products</th>
<th>Foodstuffs</th>
<th>Chemical Products</th>
<th>Plastic Products</th>
<th>Base Metals and Articles of Base Metals</th>
<th>Electrical Machines, Equipment &amp; Tools</th>
<th>Other Exports</th>
<th>Re-exports</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>150,868</td>
<td>1,182</td>
<td>5,661</td>
<td>3,758</td>
<td>1,231</td>
<td>301</td>
<td>924</td>
<td>2,414</td>
<td>166,339</td>
</tr>
<tr>
<td>1991</td>
<td>163,308</td>
<td>1,403</td>
<td>5,513</td>
<td>3,401</td>
<td>1,043</td>
<td>390</td>
<td>1,269</td>
<td>2,297</td>
<td>178,624</td>
</tr>
<tr>
<td>1992</td>
<td>174,243</td>
<td>1,578</td>
<td>5,742</td>
<td>2,736</td>
<td>897</td>
<td>493</td>
<td>1,091</td>
<td>1,545</td>
<td>188,325</td>
</tr>
<tr>
<td>1993</td>
<td>144,636</td>
<td>1,656</td>
<td>5,819</td>
<td>2,530</td>
<td>869</td>
<td>460</td>
<td>1,273</td>
<td>1,527</td>
<td>158,770</td>
</tr>
<tr>
<td>1994</td>
<td>142,829</td>
<td>1,430</td>
<td>7,878</td>
<td>3,370</td>
<td>943</td>
<td>546</td>
<td>1,282</td>
<td>1,312</td>
<td>159,590</td>
</tr>
<tr>
<td>1995</td>
<td>163,083</td>
<td>1,589</td>
<td>10,166</td>
<td>5,455</td>
<td>2,631</td>
<td>851</td>
<td>1,866</td>
<td>1,762</td>
<td>187,403</td>
</tr>
<tr>
<td>1996</td>
<td>203,743</td>
<td>1,339</td>
<td>10,435</td>
<td>4,289</td>
<td>2,396</td>
<td>1,065</td>
<td>1,840</td>
<td>2,321</td>
<td>227,428</td>
</tr>
<tr>
<td>1997</td>
<td>200,249</td>
<td>1,660</td>
<td>11,036</td>
<td>5,662</td>
<td>3,002</td>
<td>1,076</td>
<td>2,285</td>
<td>2,473</td>
<td>227,443</td>
</tr>
<tr>
<td>1998</td>
<td>122,461</td>
<td>1,663</td>
<td>9,961</td>
<td>4,152</td>
<td>2,200</td>
<td>1,022</td>
<td>2,133</td>
<td>1,796</td>
<td>145,388</td>
</tr>
<tr>
<td>1999</td>
<td>168,727</td>
<td>1,768</td>
<td>9,189</td>
<td>3,529</td>
<td>2,175</td>
<td>873</td>
<td>1,953</td>
<td>1,869</td>
<td>190,084</td>
</tr>
<tr>
<td>2000</td>
<td>265,747</td>
<td>1,700</td>
<td>12,125</td>
<td>3,805</td>
<td>1,982</td>
<td>951</td>
<td>2,357</td>
<td>1,886</td>
<td>290,553</td>
</tr>
</tbody>
</table>

*Source: SAMA.*
**Import**

Total imports into Saudi Arabia vary from one year to another. In 1992 the total was worth 124.6 billion SR but that was only because of the Gulf War. In 1994, the figure dropped to 87.4 billion SR. In the period between 1995 and 1997, the total cost of imports varied between 103 and 107 billion SR. The figure increased in 1998 to 112.4 billion SR, in spite of the sharp decrease in oil prices. However, the figure dropped in 1999 to 104.5 billion SR but it then increased in the year 2000 to 113 billion SR.

Imports by sector in Table 2.3 show that machinery, mechanical appliances, electrical equipment, and transport equipments made one third of total imports. In 1990, transport equipment was 20.4% of total imports. In 1992, as a result of the Gulf War, the percentage rose to 24%. It stayed around 20% in the years 1993 and 1994 then dropped to 14% in 1995. Transport imports stayed around 15% in the years 1996, 1997 and 1999, and 17.7% in the year 2000. Machinery equipment, on the other hand, increased constantly between 1990 and 1999, and dropped to 22% in 2000. The percentage of machinery equipment increased from 16.4% in 1990 to 24% in 1999. The other important segments of imports are base metal and associated articles with an average of 9%, precious and semi-precious metal and stones with an average of 5.5%, textiles with an average of 7%, and products chemical with an average of 8%.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Imports</td>
<td>90,282</td>
<td>108,934</td>
<td>124,606</td>
<td>105,616</td>
<td>87,449</td>
<td>105,187</td>
<td>103,980</td>
<td>107,643</td>
<td>112,397</td>
<td>104,980</td>
<td>113,241</td>
</tr>
<tr>
<td>1. Live Animals And Animal Products</td>
<td>4,838</td>
<td>5,613</td>
<td>3,771</td>
<td>3,720</td>
<td>5,233</td>
<td>5,071</td>
<td>4,891</td>
<td>5,107</td>
<td>5,313</td>
<td>5,675</td>
<td>5,675</td>
</tr>
<tr>
<td>2. Vegetable Products</td>
<td>3,880</td>
<td>3,653</td>
<td>6,484</td>
<td>5,511</td>
<td>5,441</td>
<td>6,615</td>
<td>7,674</td>
<td>7,905</td>
<td>6,868</td>
<td>7,637</td>
<td>8,268</td>
</tr>
<tr>
<td>3. Animal &amp; Vegetable Fats, Oils &amp; Their Products</td>
<td>403</td>
<td>490</td>
<td>551</td>
<td>400</td>
<td>462</td>
<td>902</td>
<td>800</td>
<td>654</td>
<td>880</td>
<td>930</td>
<td>784</td>
</tr>
<tr>
<td>4. Prepared Foodstuffs, Beverages, Spirits, Vinegar &amp; Tobacco</td>
<td>3,639</td>
<td>4,446</td>
<td>2,420</td>
<td>1,819</td>
<td>2,079</td>
<td>4,411</td>
<td>4,411</td>
<td>5,298</td>
<td>4,761</td>
<td>4,192</td>
<td>5,531</td>
</tr>
<tr>
<td>5. Mineral Products</td>
<td>760</td>
<td>844</td>
<td>916</td>
<td>1,781</td>
<td>1,313</td>
<td>1,182</td>
<td>1,159</td>
<td>1,092</td>
<td>1,055</td>
<td>1,274</td>
<td>1,062</td>
</tr>
<tr>
<td>6. Products Of Chemical &amp; Allied Industries</td>
<td>7,232</td>
<td>8,066</td>
<td>8,398</td>
<td>7,605</td>
<td>6,242</td>
<td>8,382</td>
<td>8,713</td>
<td>9,249</td>
<td>9,494</td>
<td>9,512</td>
<td>9,411</td>
</tr>
<tr>
<td>8. Raw Hides &amp; Skins, Fur Skins &amp; Articles Thereof, Travel Goods &amp; Hand Bags</td>
<td>358</td>
<td>435</td>
<td>438</td>
<td>418</td>
<td>334</td>
<td>376</td>
<td>355</td>
<td>371</td>
<td>381</td>
<td>381</td>
<td>394</td>
</tr>
<tr>
<td>9. Wood &amp; Articles Of Wood Charcoal, Cork &amp; Articles Of Cork &amp; Wicker Work</td>
<td>1,249</td>
<td>1,564</td>
<td>2,040</td>
<td>2,007</td>
<td>1,616</td>
<td>1,592</td>
<td>1,463</td>
<td>1,332</td>
<td>1,434</td>
<td>1,259</td>
<td>1,444</td>
</tr>
<tr>
<td>10. Paper Making Materials, Paper Card Board &amp; Articles Thereof</td>
<td>1,736</td>
<td>1,879</td>
<td>1,940</td>
<td>2,086</td>
<td>2,018</td>
<td>2,828</td>
<td>2,295</td>
<td>1,914</td>
<td>2,305</td>
<td>2,087</td>
<td>2,356</td>
</tr>
<tr>
<td>11. Textiles &amp; Textile Articles</td>
<td>7,947</td>
<td>9,169</td>
<td>9,842</td>
<td>8,272</td>
<td>6,410</td>
<td>7,913</td>
<td>7,589</td>
<td>7,093</td>
<td>7,464</td>
<td>6,494</td>
<td>6,674</td>
</tr>
<tr>
<td>12. Footwear, Headgear, Umbrellas, Sunshades Whips, Artificial Flowers, Articles of Human Hair &amp; Fans</td>
<td>895</td>
<td>1,194</td>
<td>1,048</td>
<td>996</td>
<td>822</td>
<td>1,086</td>
<td>1,120</td>
<td>1,026</td>
<td>1,082</td>
<td>935</td>
<td>899</td>
</tr>
<tr>
<td>13. Articles of Stone Plaster, Asbestos, Ceramic Products, Glass &amp; Glassware</td>
<td>1,677</td>
<td>1,846</td>
<td>2,314</td>
<td>2,053</td>
<td>1,697</td>
<td>1,693</td>
<td>1,749</td>
<td>1,472</td>
<td>1,460</td>
<td>1,392</td>
<td>1,931</td>
</tr>
<tr>
<td>14. Pearls, Precious &amp; Semi-Precious Stones, Precious Metals, Articles &amp; Imitation Jewellery</td>
<td>6,213</td>
<td>5,332</td>
<td>5,911</td>
<td>3,251</td>
<td>2,954</td>
<td>4,237</td>
<td>4,399</td>
<td>8,237</td>
<td>6,263</td>
<td>5,113</td>
<td>4,574</td>
</tr>
<tr>
<td>15. Base Metal &amp; Articles Of Base Metals</td>
<td>7,830</td>
<td>9,931</td>
<td>11,182</td>
<td>10,650</td>
<td>8,108</td>
<td>10,857</td>
<td>10,396</td>
<td>9,717</td>
<td>10,743</td>
<td>8,808</td>
<td>8,895</td>
</tr>
<tr>
<td>17. Transport Equipment</td>
<td>18,471</td>
<td>22,868</td>
<td>29,911</td>
<td>21,964</td>
<td>18,058</td>
<td>15,171</td>
<td>15,903</td>
<td>16,737</td>
<td>20,706</td>
<td>15,201</td>
<td>19,995</td>
</tr>
<tr>
<td>19. Arms, Ammunition &amp; Parts Thereof</td>
<td>28</td>
<td>45</td>
<td>454</td>
<td>507</td>
<td>90</td>
<td>579</td>
<td>411</td>
<td>1,001</td>
<td>987</td>
<td>636</td>
<td>788</td>
</tr>
<tr>
<td>20. Miscellaneous Manufactured Articles</td>
<td>1,751</td>
<td>2,650</td>
<td>2,925</td>
<td>2,455</td>
<td>1,947</td>
<td>2,028</td>
<td>1,935</td>
<td>2,038</td>
<td>2,133</td>
<td>1,929</td>
<td>2,264</td>
</tr>
<tr>
<td>21. Work Of Art Collection Pieces &amp; Antiques</td>
<td>244</td>
<td>303</td>
<td>333</td>
<td>324</td>
<td>332</td>
<td>274</td>
<td>345</td>
<td>393</td>
<td>330</td>
<td>127</td>
<td>23</td>
</tr>
</tbody>
</table>

Source: SAMA.
Budget Deficits

After presenting the data on the sectoral composition of the Saudi economy and the importance of oil in the economy, we now turn our attention to the governments' budget. The Saudi budget derives 75% of its revenue from oil. Since 1981, these have been inadequate to match expenditure resulting in budget deficits nearly every year since then. The deficit was substantial in the mid 1980s when oil prices and oil production declined, and in the early 1990s as a result of the cost of the Gulf crises. Figure 2.3 shows the continuous budget deficit until year 2000. Reducing budget deficit can be achieved by increasing non-oil government revenue or by cutting government expenditure. Cutting expenditure can be done by privatization of some sectors that were subsidized by government such as electricity, the national airline, postal services, railways, and port services. Such a privatisation program, however, requires a well-structured stock market.

Figure 2.3: Budget Deficit/Surplus 1992-2000

![Budget Deficit/Surplus 1992-2000](image)

Source: SAMA.
Public Debt

The deficit in the budget forced the government to borrow from the commercial banks and the two large government pension funds. According to the Saudi American Bank report issued in 2002, the total national debt of Saudi Arabia reached 630 billion SR ($171 billion) in 2001. The debts are all owed domestically and denominated in Riyals and represent 99% of preliminary 2001 GDP of S.R. 637 billion. The negative implication of large debt comes from servicing it to a point in the budget where an interest payment, or “debt servicing”, reduces the amount of intended expenditure on infrastructure. Assuming average charge of 5% on SR 630 billion, interest would total about SR 31.5 billion. If this cost was to rise to 6% the interest would amount to SR 38 billion. Again, a well-established stock market would help in reducing the debt and allow the government to sell bonds to the public, rather than concentrating on having to cut expenditure in those areas of economic activity it considers vital.

Demographics and Unemployment

Based on World Bank statistics and the Saudi Central Department of Statistics report for 2001, the population of Saudi Arabia to be 21.4 million with an annual growth of 3.3 and a fertility rate (birth per woman) of 5.4 compared to the world average of 2.7%. 45.6% of the population of Saudi Arabia is 14 years old or younger and 73.5% is 29 years old or younger. These statistics mean that the Saudi economy faces a challenge to create jobs at a high level as new segments of job seekers enter the labour market every year.
There are no reliable data on the unemployment rate, but it is argued that it is about 15%. The latest five-year plan covering 2000-2004 estimates that 817000 Saudis will enter the labour market in this period – an average of 163,000 per year. Saudi female participation in the labour market is also expected to expand. According to the SAMA Annual Report 2000, the proportion of females in the Saudi labour market accounts for no more than 6% despite the fact that a large portion of Saudi female applicants to the labour market hold a university degree. The creation of jobs in Saudi Arabia relies largely on the private sector, as the government sector cannot grow at a high enough rates.

2.2.3 Economic Reform and Privatisation

In recent years, the Saudi economy has struggled with a number of major macroeconomic problems. To overcome these problems, the government has undertaken a comprehensive economic reform and privatisation programme. In order to support economic reform programs and privatization, a Supreme Economic Council was established in August 1999. The objectives of the council were to enforce the following:

1. Security and welfare of the society.
2. Regular growth of the national economy at an appropriate level that may ensure a real increase in per capital income.
4. Provision of productive employment opportunities and optimum employment indigenous.

5. Controlling public debt within secure and reasonable limits.

6. Ensuring fair distribution of income, investment and work opportunities.

7. Diversification of the economic base and increases in public revenues.

8. Development of savings and the creation of sound saving and investment channels.

9. Working to boost government income and linking it to the growth of the national economy in a manner that would enable the government to perform its responsibilities with regard to nation development and comprehensive care of the population.

10. Enabling the national economy to offer flexibility and efficient interaction with international economic variables.

11. Expanding private sector contribution to the national economy through its participation in government privatization programmes.

The privatization program in Saudi Arabia seeks to achieve the following objectives:

1. Reducing the government’s role in the economic production process which the private sector could undertake.

2. Expanding the role of the private sector in the national economy.

3. Realizing greater efficiency in services, management and operations.
4. Alleviating the burden on the state budget as a result of eliminating subsidies which some public utilities received before the transfer of their ownership to the private sector.

5. Enhancing competition in order to accelerate economic growth.

6. Giving the opportunity to the private sector to provide services parallel to existing government services in such areas as education and health through the establishment, management and operation of private schools and hospitals.

7. Attracting foreign investment, especially for which the Kingdom has amended its Foreign Investment Regulations to provide more incentives.

8. Continue development and deepening of the capital market.

It is hoped that these objectives can be achieved after setting up an appropriate legal and regulatory structure for the privatization process in the Saudi economy to ensure competition and avoid monopolistic tendencies. This includes a well-structured and well-functioning stock market.

However, in June 2003, the Saudi Council of Ministers approved the new capital market law. Before the approval of this law, the Saudi stock market had no independent regulatory authorities that control its activities. The new capital market law created an independent commission called “Security and Exchange”. The commission reports directly to the President of the Council of Ministers and is responsible for issuing rules, directives and implementing these provisions. The new market law will be beneficial in achieving some of the objectives of the seventh five-year plan. The main objectives of this plan are as follows:
1. To increase non-oil government revenues.

2. To reduce the budget deficit to the lowest possible level.

3. To finance the deficit (if any) through issuing development bonds.

4. To use surpluses of government oil revenues to reduce public debt.

5. To maintain strict adherence to approved expenditure limits by ensuring that the limits are not exceeded during the fiscal year.

Increasing non-oil revenues as one of the plan objectives can be achieved only by increasing the role of the private sector in development. The new market law, through improving the primary market procedures, will encourage the flotation of more industrial and service companies to improve the share of the non-oil sector in the GDP.

The new law will help the government to sell its shares in major companies like SABIC. The sale can be done either directly to the public through the new established Saudi exchange “secondary market” or through the investment fund which the new law now permits. This law will also help in promoting the privatization programme. This programme can be carried either by offering shares directly to public in the secondary market or through underwriters. Privatization of sectors that provide services to the public, and depend on government subsidies like electric power, national airlines, postal services, railways, and similar activities, will help in reducing budget deficits.

Finally, the law will facilitate the sale of government development bond to the public to finance any deficits. The new law permits investment in other securities than those
of the joint stock companies to be traded in the market. The new law has defined securities as:

a. Convertible and negotiable share of companies.
b. Bonds and other negotiable investment of debts issued by companies, the government, public institutions or public organisations.
c. Investments units issued by investment funds.
d. Any instrument representing profit participation rights, any rights in the distribution of assets.
e. Any other right or instruments which the board of the commission determines should be included or traded as securities.

A detailed analysis of the stock market components during the period of this study is discussed in the next section.
2.3 THE SAUDI STOCK MARKET

It is a well known fact that the level of economic development and growth is closely related to the level of the financial sector's development. The financial markets influence the speed of development in other sectors by stimulating savings and transferring these savings to the most efficient investment projects. It is also true that economic growth without well-developed financial markets will be detrimental to long-run growth prospects. In this respect, the design and organisation of financial institutions and the markets are vitally important for sustained growth.

The Saudi stock market is considered to be one of the largest stock markets in the Middle East and North African (MENA) region. Based on the Emerging Markets Fact Book (EMF) 2001, the Saudi stock market was the second largest in the MENA region in year 2000 with a capitalisation of $67 billion. The leading market was Turkey with a market capitalisation of $70 billion (Table 2.4). However, relative to the large capitalisation of the market, the number of listed companies is 75. This must be considered as very small. Jordan, for example, has 163 companies listed in its market with a 5 billion dollars capitalisation while Egypt has more than one thousand listed companies with a market capitalisation of 28.7 billion dollars. This large capitalisation, in spite of the small number of companies, makes the average size of a Saudi company listed on the stock market very big. The average size of the companies is 895.6 million dollars compared with 26.4 in Oman, 30.3 in Jordan and 26.7 in Egypt.
The Saudi stock market is closed to foreign investors other than Gulf Cooperation Council citizens (G.C.C). It has been permitted in 1999 to allow foreign investors to invest through funds managed by Saudi banks.

Table 2.4: Capitalisation of Stock Market in MENA Region

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of listed companies</th>
<th>Market Capitalisation</th>
<th>Average Company Size (million dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>75</td>
<td>67171</td>
<td>895.6</td>
</tr>
<tr>
<td>Turkey</td>
<td>315</td>
<td>69659</td>
<td>221.1</td>
</tr>
<tr>
<td>Egypt</td>
<td>1067</td>
<td>28741</td>
<td>26.7</td>
</tr>
<tr>
<td>UAE</td>
<td>54</td>
<td>23262</td>
<td>N/A</td>
</tr>
<tr>
<td>Kuwait</td>
<td>77</td>
<td>20772</td>
<td>269.8</td>
</tr>
<tr>
<td>Morocco</td>
<td>53</td>
<td>10899</td>
<td>205</td>
</tr>
<tr>
<td>Bahrain</td>
<td>42</td>
<td>6624</td>
<td>157.7</td>
</tr>
<tr>
<td>Qatar</td>
<td>22</td>
<td>5152</td>
<td>234.2</td>
</tr>
<tr>
<td>Jordan</td>
<td>163</td>
<td>4943</td>
<td>30.3</td>
</tr>
<tr>
<td>Oman</td>
<td>131</td>
<td>3463</td>
<td>26.4</td>
</tr>
</tbody>
</table>


In what follows, we will shed some light on various aspects of the Saudi stock market. A brief overview of the Saudi stock market can be achieved by examining its components and understanding the interdependent relationship between these components. To this end, we will first look at historical developments of the market and then present the market's organisational structure, operational structure and major characteristics of the market.
Figure 2.4: Market Capitalisation in the MENA Region.

2.3.1 The Historical Development of the Saudi Stock Market

The first company to go public in Saudi Arabia goes back to 1934 when the Arab automobile company was established. This was followed by eight other companies which went public in the period 1935-73; namely, Riyadh Bank, Chemical Fertilizer, Saudi Refinery, Saudi National Gas, Saudi Gypsum, Saudi Cement and Yamamah Cement. In addition, various electric companies scattered over different cities in Saudi Arabia were grouped into four major companies which then went public. Starting from 1973, a number of major changes occurred in the Saudi economy, which still affects the structure and the working of the Saudi stock market today. These milestones in the establishment of the Saudi stock market can be identified as a result of the boom of oil prices.

In the year 1973, the Saudi economy witnessed dramatic changes in its structure when oil prices increased substantially. This resulted in substantial increase in Saudi oil revenue from 25 billion SR in 1973 to 97 billion in 1975 reaching 279 billion riyals in 1980 (1$ = 3.75 SR). This massive increase in wealth, in a relatively short span of time, was needed to be channelled into investment to achieve development of the country and for distribution to the public.

Between 1975 and 1980, the financial sector was dominated by foreign banks and the Saudi government launched an extensive infrastructure programme. The Saudi government had two alternatives: either to create Saudi banks, which were problematic because of the lack of professional bankers and the necessary technology; or Saudize (nationalise) the foreign banks working in the country in order to utilize
the existing resources. The government, of course, chose the second alternative and persuaded the foreign banks to sell 60% of their shares to the Saudi public. At that time, eight banks were offered to the public, namely, the Al-Jazzier Bank, the Investment Bank, the Saudi Hollandi Bank, the Saudi French Bank, the Saudi British Bank, the Arab National Bank, the Saudi Cairo Bank, and the Saudi United Bank. Shares in these banks were offered to the public at their par value which was far below their actual value. The offer was limited to the Saudi nationals only; every Saudi was able to sell his shares at four times the value he paid for them or more. This, of course, attracted the public to financial market activity and induced them to be more involved in the economic activities. At the same time, another fifteen companies were offered to the public. In most of these companies, the government was the major founder; it guaranteed a dividend even if the company was losing. By the end of 1980, there were about thirty companies covering most of the economic activities traded among the public.

The massive offer of shares left hundreds of thousands of shares in the hands of the public because Saudi Arabia, by that time, had neither a secondary market to trade these shares nor regulations or laws to regulate their trading. A large number of the people were willing to sell these shares and many investors were willing to buy. But there was no market to match supply with demand. As the need for a middleman to match supply with demand was urgent, a group of informal brokers emerged to handle this task. According to the Inter-Arab Investment Guarantee Corporation (IAIGC), in 1985 the number of informal trading offices in the four major cities of Saudi Arabia was 32. The brokers’ offices played a key role in shaping the Saudi stock market later on. Broker offices were used to sell and buy shares, especially in
the banking sector, on behalf of the big business families. The supply and demand of shares was controlled by the brokers, as it was common to find bids but no offer or vice-versa. Yet, shares were priced unfairly in the most cases. Every year these offices used to close for three months to settle their transactions and clear their positions. Hundreds of millions of Riyals flowed around these offices without any kind of legal framework or regulation.

However, this did not last for long. The crash of the Kuwaiti parallel stock market, Al-Manakh, in 1982 became a turning point in the regulation and establishment of an official stock market in Saudi Arabia. Al-Manakh was established in 1974 when many companies registered in Bahrain were refused to be listed in the formal Kuwait stock market. Between 1976 and 1977 both the Kuwait parallel market and the secondary market experienced a wave of speculation fuelled by forward trading and post dated cheques. As a result, both markets collapsed. The government of Kuwait intervened by regulating the market, banning forward and margin trading. Meanwhile, the government of Kuwait bought shares in the market to stop any further decline in prices. The market regained stability for a time but the feeling that speculators would be protected by the government encouraged them to start another wave of speculation using post dated checks. The value of these checks was estimated at billions of dollars.

The new wave of speculation caused a severe collapse in both markets in 1982. According to Mallaiki (1990:12) the gross value of post-dated cheques registered after the collapse was 93 billion dollars. Sixty-five individuals were responsible for 53% of the total market debt. About $17 billions were related to
forward trading in official market and the rest were related to forward trading in Al-
Manakh market. The crash of Kuwait stock exchange traumatised the whole Gulf
region including Saudi Arabia.

Following the collapse of the Kuwait stock market and the Al-Manakh crises,
the Saudi authorities felt that Saudi market was also under threat of a similar crisis. In
fact, the presence of unlicensed trading offices and the lack of regulations of a formal
body to organise, monitor, and control share trading offered strong potential for a
similar crisis. In April 1983, a royal decree was issued to form a Joint Ministerial
Committee comprising the Minister of Finance and National Economy, the governor
of the Saudi Monetary Agency (SAMA) and the Minister of Commerce. The
formation of this committee came as part of the governments desire to prevent the
kind of speculation that occurred in the unofficial Kuwait stock exchange. In June
1984, the committee finalised the groundwork for a new system of regulated stock
trading and issued it to all banks. The new system introduced in 1984 can be
summarised as follows:

i. An independent supervisory committee from the Ministry of Finance,
   SAMA and the Ministry of Commerce was established to monitor trading
   activities.

ii. A share control department under the jurisdiction of SAMA was
    established to follow the day-to-day operation of stocks trading.

iii. A share Registration Company was formed to handle settlements and
    registration activities. This company was jointly formed by Saudi banks.
iv. All brokerage activities were confined to the various banks through central units established in each bank.
2.3.2 Evaluation of the Saudi Stock Market Structure

There is no published formal structure for the Saudi stock market. Its formation came as a result of a royal decree issued in 1984. From a report published in 1985 by the Inter-Arab Investment Guarantee Corporation (IAIGC) and the royal decree issued in 1983, we can deduce the basic structure of the Saudi stock market and the relationships assigned to the various levels of management. Based on the documents mentioned above we can state that the ultimate goals for regulating the market are as follows:

i. Develop the stock market in a manner that serves the national development plan, employing used in the developed financial markets.

ii. Enhance the knowledge among both savers and investors in order to direct and deploy public savings toward the most productive sectors.

iii. Provide the tools to make financial statistics and information related to the public companies available for investors.

iv. Provide a daily price of shares and trading statistics to all users.

v. Enhance trading procedures and support liquidity in the market.

vi. Provide long term finance for existing as well as for new companies.

The structure to achieve these goals is presented in Figure 2.5. The task and responsibilities of each managerial level are also described.
Figure 2.5: Structure of the Saudi Stock Market

Source: Constructed based on different documents.
The Ministerial Committee (Strategic Level)

A ministerial committee comprises the Minister of Finance, the Minister of Commerce and the governor of the Saudi Monetary Agency (SAMA). This committee is considered as the legislative body for the stock market. It draws a broad policy to achieve the stock market's goals. It also approves certain decisions related to market activities based on the market's rules and regulations. We can summarize broad policies determined by the comities as follows:

i. Limiting the brokerage activities to commercial banks licensed in Saudi Arabia.

ii. Prohibiting any trading of shares without the mediation of banks except for direct purchases or sales carried out through the issuing company.

iii. Prohibiting the banks from selling or buying shares for their own benefit except with prior approval from the committee.

iv. Limiting trading to Saudi public companies and Saudi nationals only.

v. Listing companies only after a declaration by the Minister of Commerce about its establishment.

vi. Requiring all companies to issue a quarterly financial statement about their activities in the press.

vii. Restricting the maximum number of shares traded per transaction to 10,000 shares for each company per client per day.
Supervisory Committee (Coordinative Level)

The supervisory committee consists of the General Manager of the Public Investment Fund representing the Ministry of Finance, the General Manager of Public Companies of the Ministry of Commerce, and the General Manager of Banks Control of the Saudi Monetary Agency (SAMA). The role assigned to this committee is to develop and implement plans to achieve general policies approved by the ministerial committee. The task and responsibilities of the committee can be summarized as follows:

i. Supervise trading activities and ensure the implementation of rules and regulations.

ii. Evaluate and follow up share trading rules and regulations in order to improve their efficiency and effectiveness.

iii. Suspend trading in any shares up to a maximum length of one week and to get the Ministerial Committee's approval for any period longer than a week.

iv. Stop trading in the market as a whole after obtaining the Ministerial Committee's approval.

v. Determine the brokerage commission percentage which should not exceed 1% of the total value of shares in a transaction.

vi. Determine the information that should be included in purchase and selling orders and monitor any other procedure followed in trading.
The Shares Control Division (Executive Level)

The Shares Control Division is responsible for day-to-day operations. It is part of the banks' central department within the SAMA structure. So, although it theoretically reports to the supervisory committee, it is practically and formally reporting to the SAMA representative on the committee or to the General Manager of the Bank Control Department. The tasks and responsibilities of this division are as follows:

i. Determine shares trading working hours in the bank’s central units.
ii. Analyse market trading daily.
iii. Supervise the recruitment and selection of central unit employees.
iv. Receive deal and tackle with all traders’ complaints.
v. Publish all stock prices in the daily press and ensure that all instructions issued by ministerial and supervisory committees are sent to concerned parties such as the banks and joint stock companies.
vi. Carry out all transaction settlements and clearings with specific period of time.

The Central Trading Units (CTU)

The Central trading units are built in banks and are part of the banks’ structure. Their main responsibilities are as follows:

i. Matching and consolidating selling and purchasing orders.
ii. Confirming transactions through specific forms.
iii. Ensuring that shares have no restriction attached to them (i.e. mortgage) and that there is enough money in the owner’s account.

*The Saudi Shares Registration Company (SSRC)*

This company has been formed by the banks. It works in close coordination with the Shares Control Department. Its main function is the registration of shares and issuing of certificates that prove the ownership of shares, *Ishar*.

By analysing the structure of the Saudi stock market, we can draw the following conclusions:

i. The structure represents three managerial levels: the strategic, the coordinative, and the executive. At the strategic level, policies are drawn up to achieve the ultimate goal. At the coordinative level, the goal is transformed to objectives and plans are developed to achieve these objectives. Finally, at the executive level, plans are implemented and feedback is reported to the coordinative level to modify the plans according to reality and practice.

ii. The strategic and coordinative levels consist of a committee representing three different governmental bodies.

iii. Although it can be understood that the strategic level consists of a committee representing three high ranking officials, the coordinative level, where policies are transformed to plans, should consist of a professional and specialized department to develop these plans.
iv. As the coordinated level or middle level management consists of a committee or three members representing the three governmental agencies, they were not able to carry out their responsibilities without seeking help from an outsider consultant. In practice it is he who will develop the plans.

v. The plans developed by these expertises are implemented through the Shares Control Department, which is a division of the SAMA Bank Control Department.

vi. Feed back from executive level is reported to the SAMA representative for the supervisory committee to be studied by the consultants who modifies the plans where necessary.

From the analysis above, we can conclude that SAMA representatives have come to dominate share trading activities and regulations.
2.3.3 Evaluation of the Saudi Stock Market Operational System

After the establishment of the Ministerial Committee in 1984, the effort was made to open a trading floor and to limit brokerage activities to banks only. In order to achieve this goal, most of the work was assigned to SAMA as it has stronger ties and control in the banks. Indeed SAMA has contracted a consultant to develop rules and regulation for the trading floor. Unfortunately the floor was closed in May 1987 on the same day of its opening. No formal explanation was given for this act but rumours spread confirming that the trading offices, using their deep relationship with the religious scholars of the Ulama, used their influences in the higher echelons of power to prevent the public from dealing with banks which condoned interest or Riba. However, we believe that the Ministerial Committee have made a big mistake by ignoring the trading offices and not finding them a role in the future market.

The closing of the trading floor as a result of resistance from the Ulama and other interested groups left no choice to the Ministerial Committee but to develop an alternative system. The system was based on advanced electronic technology which connects all banks and brokerage firms with a central unit stationed in SAMA. This electronic trading system was introduced in 1990 and was called later the Electronic Shares Information System (ESIS).

Procedures for transfer of ownership used to take several months in some cases. This problem was solved by ESIS through the Saudi Shares Registration Company (SSRC). The SSRC is the manager of a central account for transferring ownership of shares and issuing notices of ownership, Ishar, as a substitute for normal certificates.
These notices are considered as proof of ownership, have all the rights and liabilities of certificates and can be traded only through ESIS. This procedure has reduced time required for the transfer of ownership to two days and protected traders as all the payments are supervised by banks.

As seen above, the ESIS system limited the trading of shares to the banks alone. This has not only protected all traders since all payments are supervised by the banks, but increased confidence in the market. Figure 2.6 shows the procedures implemented by ESIS and the steps which must be followed in selling or buying shares. Those who want to sell or buy stocks in the market should, as a first step, fill in orders and sign them at specialized ESIS bank branches. The system electronically verifies the ownership documents of sellers and makes sure that clients already exist on their database. In Figure 2.5, this is shown in boxes 1 and 2. Once these orders are entered into the electronic system by the specialised ESIS bank branches, they are electronically transferred to the Central Trading Units and appear on the screen (route from 3 to 4 in the figure). The CTU then manages and maintains these orders and generates bids and offers from orders. After confirming these bids and offers by the CTU, they are transferred electronically to the stock screen so that they can be viewed by all the other CTUs (route from 6 to 8).
Figure 2.6: Trading System Introduced By the ESIS.

1. Fill and sign orders
2. Electronically verify ownership documents and investors details existence in system
3. Enter orders into system
4. Transfer orders to CTU
5. CTU manages and maintains orders
6. Generate bids and offers
7. CTU confirms bids and offers
8. Display orders on stock screen
9. Offers and orders remain on screen until matched or removed
10. Matched
11. Generate transactions from offers and orders
12. Electronically transfer transactions to finalization system
13. Electronically finalize transactions
14. Generate reports on transfer instructions and send them to trading companies
15. Print invoice at CTU
16. Certificate requested
17. Finalize transactions satisfying conditions for trading
18. Print trading reports
19. Send reports to SAMA
20. Send instructions on transfer to trading companies, and collect shares certificates and Hand them to bank

Start
The system tries to find best matches between bids and offers according to time and price. Unmatched bids and offers remain on screen until matched or removed from display. The CTU may change or cancel any order on client request as long as it is still on screen. These are shown in boxes 9 and 10 in Figure 2.6. Transactions are generated from matching bids and offers. The results are transferred electronically to the finalizing system which supervises all transactions to be finalized (route from 11 to 12). At night, all transactions to be finalized on that day are electronically finalized, without the need to obtain any papers or documents (box 13).

The later steps (route from 14 to 16) involve generating reports on the transfer instructions for each trading company, identifying buyers and sellers, and sending these reports to the trading companies to update their records and issuing share certificates which replace the original ownership documents to those clients who ask for them. For other clients wishing to obtain invoices instead of certificates, the system prints these invoices at the CTUs. In steps 17 to 19, the finalizing system completes all transactions satisfying trading conditions. The system then prints trading reports and send those to SAMA in order to credit debit a banks’ trading accounts. Finally, the Saudi Share Registration Company (SSRC) sends transfer instructions to the trading companies, collects the share certificates, and sends them to the banks which then hand them on to the clients.

The electronic system (ESIS) is accessible from 10 am to 12 noon in the first trading session, and from 4.30 pm to 6.30 pm in the second session from Saturdays to Wednesdays, and from 10 am to 12 noon on Thursdays. The introduction of ESIS is
considered a major development in Saudi stock market history. The system is fully automated and provides depository and registration functions through the Saudi Share Registration Company. The system prohibits repetition short selling trading as only the holders of physical shares are allowed to trade.
2.3.4 Evaluation of the Saudi Stock Market Performance

The Saudi stock market has gone through several events in the 1990s, such as the introduction of the ESIS which allows Saudi nationals to buy and sell shares in all Saudi cities through the commercial banks. Below we examine the performance of the Saudi stock market for the period 1990 to 2000. This examination will include the number of shares traded, their value, the number of transactions, and the market indexes.

**Number of Shares Traded**

Table 2.5 presents the number of shares traded in various sectors of the stock market in the period 1990 to 2000. The table shows that the service sector had the highest number of traded shares in the market with a total of 800 million. Observing the annual percentage changes in the various sectors, we notice that all sectors underwent positive change most years. Shares trading in 1997 witnessed a substantial increase. The number of shares traded in the banking sector increased by 146%, in the industry sector by 130% and in the service sector by 159%. Finally, one major observation can be noticed: both the banking and the service sectors have witnessed a decrease in the number of shares traded between 1999 and 2000s. This may indicate that traders in these two sectors held their shares for long term investment.
### Table 2.5: Number Of Shares Traded From 1990 To 2000.

<table>
<thead>
<tr>
<th>Period</th>
<th>Banking</th>
<th>Industry</th>
<th>Cement</th>
<th>Services</th>
<th>Electricity</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>2,453,089</td>
<td>4,236,573</td>
<td>4,126,478</td>
<td>3,660,715</td>
<td>1,518,901</td>
<td>942,630</td>
</tr>
<tr>
<td>1991</td>
<td>5,998,827</td>
<td>6,408,850</td>
<td>5,372,923</td>
<td>11557926</td>
<td>1,690,416</td>
<td>2,593,480</td>
</tr>
<tr>
<td>1992</td>
<td>6,138,127</td>
<td>7,654,973</td>
<td>2,951,953</td>
<td>11987312</td>
<td>1,588,252</td>
<td>4,053,495</td>
</tr>
<tr>
<td>1993</td>
<td>13,748,005</td>
<td>13,124,380</td>
<td>1,609,749</td>
<td>26,928,081</td>
<td>1,588,252</td>
<td>3,309,161</td>
</tr>
<tr>
<td>1994</td>
<td>15,096,764</td>
<td>47,802,100</td>
<td>5,580,357</td>
<td>73,336,053</td>
<td>1,848,253</td>
<td>9,088,637</td>
</tr>
<tr>
<td>1995</td>
<td>27,189,722</td>
<td>38,765,411</td>
<td>8,854,809</td>
<td>35,202,846</td>
<td>1,326,233</td>
<td>5,278,918</td>
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<tr>
<td>1996</td>
<td>31,860,296</td>
<td>19,924,784</td>
<td>29,804,145</td>
<td>48,010,923</td>
<td>2,309,169</td>
<td>5,923,243</td>
</tr>
<tr>
<td>1997</td>
<td>78,225,938</td>
<td>45,902,503</td>
<td>37,899,445</td>
<td>124,145,566</td>
<td>10,583,760</td>
<td>17,218,126</td>
</tr>
<tr>
<td>1998</td>
<td>129,699,957</td>
<td>56,893,625</td>
<td>21,137,344</td>
<td>71,654,808</td>
<td>8,066,767</td>
<td>7,184,703</td>
</tr>
<tr>
<td>1999</td>
<td>156,121,541</td>
<td>82,509,623</td>
<td>33,862,362</td>
<td>226,967,729</td>
<td>19,643,425</td>
<td>8,401,026</td>
</tr>
<tr>
<td>2000</td>
<td>92,106,828</td>
<td>159,190,656</td>
<td>46,247,570</td>
<td>175,429,658</td>
<td>58,285,130</td>
<td>23,653,601</td>
</tr>
<tr>
<td>Total</td>
<td>558,499,794</td>
<td>482,413,478</td>
<td>197,447,135</td>
<td>808,881,617</td>
<td>107,784,828</td>
<td>87,647,020</td>
</tr>
</tbody>
</table>

Source: SAMA.

### Value of Traded Shares

Table 2.6 presents the value of shares traded in various sectors of Saudi stock market in the period from 1990 to 2000 together with their annual percentage change.

It is clear from the table that the banking sector has the highest values comparing to other sectors as the value increased from 2.2 billions in 1990 to 29 billions in 2000. The banking sector has a positive change (in percentage) for all years except for 1994. The biggest increase of the value of traded shares in the banking sector occurred in 1997 when the value of shares jumped from 10.4 to 29.2, and continued to increase to reach 34 billions in year 1999. In year 2000, the value of traded of shares decreased to reach 29.5, this can be attributed to the low number of shares traded mentioned before. Value of shares traded in other sector also has increased during the same period. For example, the value shares traded in the industrial sector has increased...
from one billion in 1990 to 20 billions in year 2000. Other sectors also witnessed similar improvement.

Table 2.6: Value of Traded Shares

<table>
<thead>
<tr>
<th>Period</th>
<th>Banking</th>
<th>Industry</th>
<th>Cement</th>
<th>Services</th>
<th>Electricity</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>2,257,328</td>
<td>1,027,492</td>
<td>614,522</td>
<td>231,383</td>
<td>167,972</td>
<td>104,538</td>
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<td>1991</td>
<td>3,612,744</td>
<td>2,219,467</td>
<td>949,457</td>
<td>1,343,938</td>
<td>194,416</td>
<td>207,285</td>
</tr>
<tr>
<td>1992</td>
<td>7,096,200</td>
<td>2,942,903</td>
<td>865,047</td>
<td>2,060,669</td>
<td>311,134</td>
<td>422,879</td>
</tr>
<tr>
<td>1993</td>
<td>8,642,496</td>
<td>3,518,526</td>
<td>479,485</td>
<td>4,162,184</td>
<td>213,169</td>
<td>344,174</td>
</tr>
<tr>
<td>1994</td>
<td>6,189,320</td>
<td>8,056,416</td>
<td>976,496</td>
<td>8,935,826</td>
<td>129,630</td>
<td>583,387</td>
</tr>
<tr>
<td>1995</td>
<td>7,832,275</td>
<td>10,383,196</td>
<td>1,403,662</td>
<td>3,199,003</td>
<td>120,135</td>
<td>288,320</td>
</tr>
<tr>
<td>1996</td>
<td>10,406,069</td>
<td>5,717,344</td>
<td>5,341,778</td>
<td>3,456,396</td>
<td>186,448</td>
<td>289,294</td>
</tr>
<tr>
<td>1997</td>
<td>29,279,641</td>
<td>11,009,473</td>
<td>8,156,547</td>
<td>11,571,535</td>
<td>1,132,184</td>
<td>910,976</td>
</tr>
<tr>
<td>1998</td>
<td>32,820,282</td>
<td>9,520,069</td>
<td>3,484,102</td>
<td>4,557,806</td>
<td>788,844</td>
<td>338,056</td>
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<tr>
<td>1999</td>
<td>34,870,322</td>
<td>10,236,345</td>
<td>3,789,893</td>
<td>6,085,512</td>
<td>1,372,636</td>
<td>224,015</td>
</tr>
<tr>
<td>2000</td>
<td>29,520,066</td>
<td>20,392,121</td>
<td>5,238,310</td>
<td>4,820,035</td>
<td>4,646,031</td>
<td>676,324</td>
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<tr>
<td>Total</td>
<td>172,526,742</td>
<td>85,023,352</td>
<td>31,299,300</td>
<td>50,424,287</td>
<td>9,262,599</td>
<td>4,389,249</td>
</tr>
</tbody>
</table>

Source: SAMA.

Number of Share Transactions

Table 2.7 presents the number of share transactions by sectors. The number of transactions may be a good indicator of the number of people trading in the market. The table shows that the industrial sector was the most active sector as the number of transactions increased from 1700 in 1990 to 172000 in 2000. Looking at all sectors we notice that 1997 witnessed an enormous increase; the number of transactions for banking sector increased by 57%, for industry by 63%, and for the service industry by 82%. Other sectors also achieved a notable increase. The thing we should observe in Table 5.13 is that the number of transactions decreased by 28% in the banking sector.
and by 15% in services in year 2000 while it increased in other sectors. This may indicate that traders have abandoned these two sectors in favour of other sectors.

Table 2.7: Number of Share Transactions

<table>
<thead>
<tr>
<th>Period</th>
<th>Banking</th>
<th>Industry</th>
<th>Cement</th>
<th>Services</th>
<th>Electricity</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>30,032</td>
<td>17,237</td>
<td>4,948</td>
<td>22,057</td>
<td>1,165</td>
<td>9,859</td>
</tr>
<tr>
<td>1991</td>
<td>23,115</td>
<td>-23%</td>
<td>23,957</td>
<td>39%</td>
<td>4,862</td>
<td>-2%</td>
</tr>
<tr>
<td>1992</td>
<td>79,656</td>
<td>245%</td>
<td>95,741</td>
<td>240%</td>
<td>8,271</td>
<td>70%</td>
</tr>
<tr>
<td>1993</td>
<td>114,370</td>
<td>44%</td>
<td>101,307</td>
<td>8%</td>
<td>8,182</td>
<td>-1%</td>
</tr>
<tr>
<td>1994</td>
<td>67,834</td>
<td>-41%</td>
<td>112,279</td>
<td>28%</td>
<td>13,285</td>
<td>62%</td>
</tr>
<tr>
<td>1995</td>
<td>82,817</td>
<td>22%</td>
<td>98,662</td>
<td>-12%</td>
<td>19,921</td>
<td>50%</td>
</tr>
<tr>
<td>1996</td>
<td>89,328</td>
<td>8%</td>
<td>59,734</td>
<td>-39%</td>
<td>49,100</td>
<td>146%</td>
</tr>
<tr>
<td>1997</td>
<td>139,931</td>
<td>57%</td>
<td>97,654</td>
<td>63%</td>
<td>62,976</td>
<td>28%</td>
</tr>
<tr>
<td>1998</td>
<td>167,547</td>
<td>20%</td>
<td>90,176</td>
<td>-8%</td>
<td>36,173</td>
<td>-43%</td>
</tr>
<tr>
<td>1999</td>
<td>166,422</td>
<td>-1%</td>
<td>105,729</td>
<td>17%</td>
<td>44,495</td>
<td>23%</td>
</tr>
<tr>
<td>2000</td>
<td>119,576</td>
<td>-28%</td>
<td>172,321</td>
<td>63%</td>
<td>58,663</td>
<td>32%</td>
</tr>
<tr>
<td>Total</td>
<td>1,080,628</td>
<td>974,797</td>
<td>310,876</td>
<td>840,387</td>
<td>101,744</td>
<td>164,797</td>
</tr>
</tbody>
</table>

Source: SAMA.

Share Price Indexes

The general market index and sectoral indexes of Saudi stock market fluctuated in the period between 1990 and 2000. These fluctuations may reflect the state of the economy of the country. Table 2.8 shows that the general index increased in 1991 by 80% to reach its highest point in middle of 1992 exceeding 2300 points. This sharp increase from 1990 to 1992 reflects the state of the economy and the general atmosphere in Saudi Arabia. The liberation of Kuwait, the massive expenditure of war and the stability after the victory, all are reflected in the sharp increase in the general and sectoral indexes. Also, the introduction of ESIS, which
attracted more people to trade in the market, has supported this increase. The general indexes also show that the market slowed down in the years 1993 and 1994 when the general index fell by 5% and 28% respectively to reach its lowest level of 1160 in mid-1995. This decrease also reflects the fact that Saudi Arabia found itself with huge debts caused by expenditure of the war. However, the economy started to recover between 1995 and 1997 and the general index increased by 12% in 1996 and 28% in 1997.

This improvement did not last long as the indexes decreased by 28% in 1998 as a consequence of the suffering from international financial market crises which adversely affected international economic growth and crude oil prices. The performance of Saudi share market improved considerable during 1999. Yet in 1999 the index of share prices rose sharply by 44% to 2028. The shares of most joint stock companies recorded notable gains during the year. According to SAMA’s thirty-sixth annual report, the improvement in the share market index and activities was mainly attributed to the increase in oil prices and the steps taken by the government to permit foreigners to invest in the domestic share market through investment funds managed by local banks and the constitution of the supreme economic council.
### Table 2.8: Share Indexes

<table>
<thead>
<tr>
<th>End of Period</th>
<th>General Index</th>
<th>Banking</th>
<th>Industry</th>
<th>Cement</th>
<th>Services</th>
<th>Electricity</th>
<th>Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>979.77</td>
<td>1900.93</td>
<td>1428.13</td>
<td>947.22</td>
<td>574.76</td>
<td>539.52</td>
<td>1011.05</td>
</tr>
<tr>
<td>1991</td>
<td>1765.24</td>
<td>4276.23</td>
<td>2867.69</td>
<td>1382.70</td>
<td>1175.91</td>
<td>592.34</td>
<td>1362.13</td>
</tr>
<tr>
<td>1992</td>
<td>1888.65</td>
<td>4987.16</td>
<td>2590.06</td>
<td>2100.21</td>
<td>1377.52</td>
<td>603.58</td>
<td>1549.69</td>
</tr>
<tr>
<td>1993</td>
<td>1793.30</td>
<td>4913.04</td>
<td>2221.08</td>
<td>1933.37</td>
<td>1243.22</td>
<td>626.24</td>
<td>1101.87</td>
</tr>
<tr>
<td>1994</td>
<td>1282.87</td>
<td>3069.19</td>
<td>1906.90</td>
<td>1424.48</td>
<td>870.48</td>
<td>471.95</td>
<td>766.79</td>
</tr>
<tr>
<td>1995</td>
<td>1367.60</td>
<td>3278.40</td>
<td>2497.80</td>
<td>1371.60</td>
<td>682.20</td>
<td>425.60</td>
<td>689.40</td>
</tr>
<tr>
<td>1996</td>
<td>1531.00</td>
<td>3968.50</td>
<td>2695.20</td>
<td>1792.40</td>
<td>659.10</td>
<td>420.80</td>
<td>618.80</td>
</tr>
<tr>
<td>1997</td>
<td>1957.80</td>
<td>5596.70</td>
<td>3149.10</td>
<td>2041.20</td>
<td>762.30</td>
<td>570.10</td>
<td>645.90</td>
</tr>
<tr>
<td>1998</td>
<td>1413.10</td>
<td>4344.80</td>
<td>1984.00</td>
<td>1271.10</td>
<td>598.80</td>
<td>460.40</td>
<td>498.10</td>
</tr>
<tr>
<td>1999</td>
<td>2028.53</td>
<td>6438.95</td>
<td>2917.91</td>
<td>1682.16</td>
<td>589.17</td>
<td>697.98</td>
<td>454.97</td>
</tr>
<tr>
<td>2000</td>
<td>2258.29</td>
<td>7229.53</td>
<td>3514.01</td>
<td>1735.29</td>
<td>568.65</td>
<td>705.05</td>
<td>457.50</td>
</tr>
<tr>
<td>Total</td>
<td>18266.15</td>
<td>50003.43</td>
<td>27771.88</td>
<td>17681.73</td>
<td>9102.11</td>
<td>6113.56</td>
<td>9156.20</td>
</tr>
</tbody>
</table>

**Source:** SAMA.
2.3.5 Major Characteristics of the Saudi Stock Market

As stated before, the Saudi stock market differs from other markets in several aspects. In what follows, we describe the major characteristics that distinguish the market.

Redistribution of income versus allocation of funds

The most important function that stock markets perform is to channel funds into the most productive enterprises. This results in an efficient allocation of economic resources and hence, promotes economic growth. An examination of the activities of the primary market in the Saudi stock market over the period 1975-1980 reveals three important factors. First, bank shares were offered to the public at par value, which was far below their actual value. These shares were then resold in the secondary market at a price 4-5 times the value paid for them. Secondly, some companies’ shares guaranteed by the government, paid dividends of 10% to 15% on a shares par value. Dividends were given regardless of the performance of the companies. These companies were mainly in the service sectors such as electricity and transportation. Thirdly, the government was a major shareholder in most companies related to the cement and industrial sector, companies like Saudi Basic Industry (SABIC). These three factors raised questions on the goal of the primary market and on whether the intention was to allocate funds or redistribute-income, especially that the only condition to subscribe in these companies was to be a Saudi national. The market remained closed to any non-Saudi national.
Politics versus economics

As mentioned above, the stock market is an economic instrument that helps in utilizing the resources of a nation to achieve economic growth. However, in the case of Saudi stock market, we see that politics seems to be important as well as economics in the formation and the functioning of the stock market. The first aspect to note is the Saudization program for foreign banks. Such a program is very beneficial to the Saudi economy as all of the foreign banks in Saudi Arabia are branches of the world’s major banks. The Saudization program of the banks utilizes the advanced technology and expertise of those banks. However, since the started program, no more banks have been licensed in Saudi Arabia which makes these banks work in an oligopoly market. It is arguable if this is beneficial for Saudi economy in the long-term. The Saudization program and consignment of the banking sector into the hands of a small number of banks has led shares to be concentrated in small number of Saudi investors. This might be a politically oriented decision rather than an economic one.

The second aspect is the way the market was regulated. As it has been mentioned earlier, that the Ministerial Committee, which was created to monitor the activities of the market, was established as a response to the crises on the Kuwait stock exchange. The committee was developed as neither a natural development of the performance of the market nor in response to a predetermined plan. The committee assigned the function of brokerage to the banks and ignored the existence of the 32 trading offices, which offered good potential for fulfilling the role of brokerage houses if they were regulated in accordance with a preconceived plan. Again, this decision was political rather than economic. In addition, the closing of the trading floor was also based on
political rather than economic reasons. Finally, it is questionable if closing the market in the face of foreigner investors would serve the economy when the ultimate goal of a stock market is to allocate funds. It is arguable that politics rather than economics that controls governs the Saudi stock market.

*Market Concentration*

May be, the most important issue about the Saudi stock market is related to its level of concentration. All companies open to the public in Saudi Arabia fall under the supervision of the Ministry of Commerce, which must approve the formulae designed to distribute shares among subscribers. These formulae are always designed to benefit small rather than big investors. This policy is meant to help large numbers of people become involved in stock market activities. In reality, however, most shares tend to go to the big investors who keep these shares not for trading but to serve their long-term interests (Table 2.9). Only a few families are controlling the shares of the banking, cement and other important companies (Figure 2.7). Al-Dukheil (2002) argues that the Saudi stock market behaves differently to other emerging stock markets. He states that “in an emerging market, the number of share-holders expands over a period of time in response to market growth. However we observe a different trend in the Saudi stock market: the number of share-holders progressively coming down for many companies indicating a higher concentration of shares in the hands of few investors”. In the following tables selected companies are given as examples of this tendency for the number of share holders to decrease.
Table 2.9: Number of Share Holders in Years 1996 and 1998.

<table>
<thead>
<tr>
<th>Company</th>
<th>Number of Share Holders in Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1996</td>
</tr>
<tr>
<td>The Makkans Livestock Co.</td>
<td>134000</td>
</tr>
<tr>
<td>Saudi French Bank</td>
<td>12883</td>
</tr>
<tr>
<td>Saudi Hollandi Bank</td>
<td>1168</td>
</tr>
<tr>
<td>Jazeera Bank</td>
<td>33737</td>
</tr>
<tr>
<td>Riyadh Bank</td>
<td>107260</td>
</tr>
<tr>
<td>Saudi British Bank</td>
<td>17590</td>
</tr>
</tbody>
</table>

Source: Al-Dukheil (2002)

Figure 2.7: Number of Share Holders in the Banking Sector (2000).

Source: SSRC.
The livestock company (Table 2.9) gives a good example of how shares are concentrated in the hands of big investors. As the number of share-holders decreased by 96 percent in two years, so the number of share-holders in the banking sector decreased. This tendency to decrease can be attributed to the interests of certain business groups who strategically target certain companies, especially in the banking sector. Their strong ownership position enables these business groups to influence decision-making in these banks and allows them to be involved in day-to-day management via their board representation. This sort of concentration conflicts with the spirit of a joint stock company since the general assembly of a company can be held by a small number of people who have a majority of shares. It is apparent that transparency and disclosure is in danger in the light of such tight control by so few individuals. Actually the nature of these companies whether they are joint stock or partnership companies comes into question.

**Bureaucratic Constraints**

The Saudi stock market has achieved little improvement in terms of managerial performance, since the establishment of the Ministerial Committee in 1984. This low profile performance can be recognised at various levels of market activity. Firstly, in the primary market level, the average number of companies that are floated is 2-3 every year. An active primary market is a prerequisite to an active and diversified secondary market. As mentioned before the number of companies listed in the market is still very small comparing to other markets and relative to the large capitalisation of the Saudi stock market as a whole. The small number of listed
companies in the market can be attributed to the conditions, procedures and documents outlined by the authorities. Conditions and procedures are structured to ensure that only good performance companies get listed in the market. The authorities justify tight policies to avoid other countries experience such as the Al-Manakh crisis in Kuwait. However, regardless of this justification, the fact remains that the number of companies listed in the market is very limited. Revision of these procedures and conditions is a must in order to have an active and diversified secondary market.

The second bureaucratic constraint that slows market improvement is in the legislative level. In fact, until June 2003, Saudi Arabia was the only country in the Gulf region that did not have a regulated and established stock exchange with independent regulatory authorities to control it. The legislative and managerial bodies consist of committees representing three different governmental agencies. Each representative may have different perspective on evaluation decisions. Also, the dominant role of SAMA and the role of the banks in the share trading process could be another reason for retarding improvement to market activities. SAMA has full control of the day-to-day operations. Banks, on the other hand, play the role of brokers, fund managers and providers of commercial activities including the provision of loans to traders. This role may benefit the banks and give SAMA more control, but it is questionable if this is for the benefit of the market.

The third bureaucratic constraint is in the policy-making level. Closing the market in the face of foreign investment as a general policy might have been justified in the past; the government use the market as a tool for distributing income. Indeed the Saudi stock market is the only market that is totally closed – except for GCC citizens
in the region. Comparing Saudi Arabia to other Gulf countries which have similar economies we find that Kuwait, UAE, and Qatar all have an open market with restrictions. Other countries, like Oman and Bahrain have a totally free market. Table 2.10 shows polices of different countries with regard to foreign investment.

Table 2.10: Type of Markets in Some Countries.

<table>
<thead>
<tr>
<th>Market</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>Closed</td>
</tr>
<tr>
<td>Turkey</td>
<td>Free</td>
</tr>
<tr>
<td>Egypt</td>
<td>Free</td>
</tr>
<tr>
<td>UAE</td>
<td>Restricted</td>
</tr>
<tr>
<td>Kuwait</td>
<td>Restricted</td>
</tr>
<tr>
<td>Morocco</td>
<td>Free</td>
</tr>
<tr>
<td>Bahrain</td>
<td>Free</td>
</tr>
<tr>
<td>Qatar</td>
<td>Restricted</td>
</tr>
<tr>
<td>Jordan</td>
<td>Free</td>
</tr>
<tr>
<td>Oman</td>
<td>Free</td>
</tr>
</tbody>
</table>

Source: EMF

**Market Efficiency**

The market efficiency issue evolved from the possibility that an investor might consistently accumulate excess gains or profits from the application of trading rules in the transaction of financial securities. An informational efficient stock market prices fully and instantaneously reflect all available relevant information.

Fama (1970, 1976) defines three types of informational efficiency depending on the type of information used by the investors:
i. Weak-form efficiency: In a weak-form efficient market, knowledge of past price movements do not provide information about future prices. In other words, no investor can earn excess returns from trading rules based on historical price or return information.

ii. Semistrong-form efficiency: No investors can earn excess returns from trading rules using publicly available information. Trading based on earnings announcements, annual reports, divided decisions, or information in the financial press is unlikely to lead to excess returns.

iii. Strong-form efficiency: Market security prices reflect all information public and non-public. No investor can earn excess returns using any information.

As a new market, one may expect the informational efficiency level in Saudi stock market not to be high and the limited studies carried about Saudi market efficiency support this expectation. In what follows we present some of these studies.

In an early study, Malaikah (1990) examined Saudi stock market behaviour using daily stock prices collected over the period from June 14th 1986 to October 3rd 1989 for 35 stocks listed in the market. He concluded to that "Autocorrelations, runs tests, and intraday volatility measures indicate significant operational and/or informational inefficiencies in the Saudi exchange system". Al-Razeen (1997) examined the Saudi stock market efficiency by applying the weak-form test of the efficient market hypothesis over a four-year period from 1992 to 1995. He concluded that the Saudi market was not informationally efficient during that period. Al-Soayed (1997) test the weak-form efficiency using monthly data over the period from January
1991 to June 1996 for 41 companies and major indexes. She concluded that 83% of the companies listed in the market may be considered weak-form informationally efficient.

**Thin Trading**

Having discussed the efficiency of the Saudi stock market we now move to thin trading as another characteristic that distinguishes the emerging market including Saudi stock market. Thin trading (or infrequent trading) occurs when stocks do not trade at every consecutive interval.

Several studies in literature have investigated the impact of thin trading on the CAPM model result. ‘Fowler and Rorke and Jog (1979)’ investigated the effect of trading frequency on the residual behaviour of the market model in the Toronto stock exchange. Their investigations have two main thrusts; a sample of stocks of varying trading frequency were used to determine whether or not there is a relationship between; a) The thinness of trading and R2 And, b) thinness of trading in heteroscedasticity. They concluded that there is evidence of heteroscedasticity and low R2 And a noticeable dependence of these with the frequency of trading in the underlying stocks. However, they consider the possibility that the detected phenomenon is not true heteroscedasticity. But, simply non-stationarity in the distribution of the residual induced by thin trading. ‘Dimson and March (1983)’ examine the problems of estimating risk measures and their stability in the UK stock exchange. They used a sample consisting of all UK companies for which data was available on the London share prices database. The data covered the period from 1955
to December 1979 they concluded that "thin trading can lead to serious bias in risk measures. Further more, since trading frequency is stable over time, this bias will be persistent, and will import a serious stability to estimates of beta and other risk measures". However, they added that such problems can soon be overcome by using the trade to trade method for estimating risk measure which are largely free from thin trading bias. ‘Antonios, Ergul and Holmes 1997’ used Istanbul stock exchange data to study the: ‘Market efficiency, thin trading and non-linear behaviour:’ the paper discussed the potential impact of thin trading on testing market efficiency.

From previous discussion we have seen that thin trading may have impact on the error term behaviour, stability of the co-efficient beta and market efficiency. Several methodology discussed in the literature to deal with the problem of thin trading, ‘Miller (1994)’ proposed a methodology suggest that to remove the impact of thin trading, a moving average model (MA) that reflects the number of non-trading days, should be estimated and then be adjusted accordingly. However, given the difficulties in identifying the non trading days Miller has shown that it’s equivalent to estimate an AR (1) model from which the non-trading adjustment can be obtained. Specifically, this model involves estimating the following equation:

\[ R_t = \alpha_1 + \alpha_2 R_{t-1} + \epsilon_t \]  

(2.1)

Using the residual from regression, adjusted return is estimated as follows:

\[ R_t \text{ (adj)} = \frac{\epsilon_t}{1 - \alpha_2} \]  

(2.2)
Where $R_t$ (adj) is the return at time $t$, adjusted for thin trading.

Other methodology to avoid the significant bias in estimating daily return on infrequently traded shares recommends either estimating beta with weekly, monthly or annual return Dimson and March 1983. Finally we would like to conclude it assumed that the return on market portfolio is a close to random walk while return on a few individual shares has serial correlation in their residual when using daily return. However, when estimating beta with monthly returns as recommended by ‘Handa et al (1989)’ we can avoid the problem of serial correlation of residual.
2.4 CONCLUSION

In this chapter, we have provided information on the history and the structure of the Saudi stock market, and described the macroeconomic environment within which the Saudi stock market works. Discussions on the Saudi stock market and macroeconomic data reveal that the Saudi economy has undergone a number of important changes in its structure. This change in economic functions can be linked with Saudi stock market over the period 1970-2000. As discussed in the text, while the Saudi government depended heavily on oil revenues to develop its economy in the 1970s, massive declines in oil revenues in the 1980s and the 1990s forced the government to consider allowing the private sector to undertake investment and achieve industrialisation. Today, Saudi policy makers realise that the massive unemployment problem can only be solved by achieving industrialisation for this could provide sustained economic growth, diversification and modernisation of the economy and create employment opportunities.

Changing attitudes towards development have also changed the functions attributed to the Saudi stock market. As discussed in this Chapter, the Saudi market was seen as a means of distributing massive oil revenues to the public in the early 1970s. However, today, it has been provided with a legal framework and is now used to transfer savings into long-term investment to improve industrialisation. Of course, this does not mean that the Saudi stock market is a well-developed market. In many ways, it is considered more like an underdeveloped market. Nevertheless, the number of companies listed remains very small and does not reflect the general structure of the economy. Furthermore, the market is highly concentrated.
CHAPTER THREE
A REVIEW OF THEORETICAL AND EMPIRICAL LITERATURE
ON STOCK MARKET PRICING

3.1 INTRODUCTION

The main aim of this chapter is to survey the existing theoretical and empirical literature on asset pricing and to examine these arguments to provide a framework of thought that helps us to understand the underlying factors behind the changes in stock returns. In a world where the future is uncertain, a rational investor can only be persuaded to take on an investment if he or she is offered an attractive return. This is because investing in an asset involves two types of risks, namely systematic and unsystematic risks. While the systematic risk stems from macroeconomic factors and affects all assets, unsystematic risk is specific to particular assets. In addition, investors can eliminate unsystematic risk by having a diversified portfolio but the systematic risk cannot be diversified away. In other words, investors expect a higher return for taking on investments with a relatively high level of systematic risk and face the problem of calculating risk related to a particular asset. Since risk is related to the variability of a share's return, the determinants of risk are really the same as the determinants of share-price movements. Therefore, the literature on the subject focuses on providing a model that links the change in share prices to the determinants of risk.
In the literature, two models have been developed to measure the extent of risk associated with assets and hence to explain the determinants of return, namely, *Capital Asset Pricing Model* (CAPM) and *Arbitrage Pricing Theory* (APT). In both models, the rate of return is assumed to be a function of systematic and unsystematic risk. While the systematic risk factors are implicit and represented by the market portfolio in the CAPM, the APT takes explicit account of systematic risk factors in the model. The latter point will be clarified in the text below. Ultimately, the question of which model fits the data and explains stock returns is an empirical issue. Therefore, the subject matter of this chapter is to present a detailed derivation of these models providing insights into asset-pricing and surveying the existing empirical literature to understand the determinants of stock returns.

In what follows, Section 3.2 is devoted to a review and derivation of the first theory of stock market pricing, namely Capital Pricing Model (CAPM), and discusses its implications for the systematic risk and macroeconomic variables. Section 3.3 provides a detailed discussion of Arbitrage Pricing Theory including the assumption that rests behind them, the derivation of the model, and the implications for the determinants of return. A comparison between these two models is given in Section 3.4. Section 3.5 is devoted to the review of the empirical literature on the CAPM and APT model. We will also discuss the empirical problems related to both the modelling framework and the selection of systematic risk factors in this section. Section 3.6 concludes.
3.2 CAPITAL ASSET PRICING MODEL (CAPM)

Our ultimate aim in this section is to understand how shares are priced in financial markets and what determines change in stock prices. Early theoretical work on the subject was carried out by Harry Markowitz 1952, who developed the portfolio theory. The portfolio theory shows how to measure the risk of an investment and how to identify the return that should be expected from it given its level of risk. But it only explains the risk and expected return relationship of portfolios of assets. The first asset-pricing model to explain the risk-return relationship for individual assets rather than portfolios was the CAPM, which arose directly from the conclusions of portfolio theory. In the rest of this section, we present a share-pricing model, CAPM, which explains investment decision-making in stock markets and provides valuable insights into the major determinants of asset pricing.

The standard form of CAPM was developed independently by Sharpe (1964), Lintner (1965) and Mossin (1966), so it is often called the Sharpe-Lintner-Mossin form of CAPM. The assumptions of the CAPM can be enumerated as follows:

1. Investors evaluate portfolios by looking at the expected returns and standard deviations of the portfolios over a one-period horizon;
2. Investors are never satisfied, so when given a choice between two otherwise identical portfolios, they will choose the one with the higher expected return;
3. Investors are risk-averse, so when given a choice between two otherwise identical portfolios, they will choose the one with the lower standard deviation;

4. Individual assets are infinitely divisible, meaning that an investor can buy a fraction of a share if he or she so desires;

5. There is a risk-free rate at which an investor may either lend (that is, invest) money or borrow money;

6. Taxes and transaction costs are irrelevant;

7. All investors have the same one-period horizon;

8. The risk-free rate is the same for all investors;

9. Information is freely and instantly available to all investors; and

10. Investors have homogeneous expectations, meaning that they have the same perceptions about the expected returns, standard deviations, and covariances of securities.
3.2.1 Derivation of CAPM

Based on these assumptions the CAPM provides an expression for the expected return on a risky investment or on an investment in the shares of a single company. We can derive the CAPM expression mathematically by examining the characteristics of a two-asset portfolio consisting of an investment in the shares of a single company and an investment in the market portfolio. The expected return and risk of this two-asset portfolio, \( p \), would be:

\[
E(r_p) = xE(r_i) + (1-x)E(r_m)
\]  \hspace{1cm} (3.1)

\[
\sigma_p = \sqrt{x^2\sigma_i^2 + (1-x)^2\sigma_m^2 + 2x(1-x)\sigma_{im}}
\]  \hspace{1cm} (3.2)

where \( r_p, r_i \) and \( r_m \) represents the return of an inefficient portfolio \( p \), risky asset \( i \) and an efficient market portfolio respectively. While \( \sigma_p, \sigma_i, \) and \( \sigma_m \) represent the respective riskiness of portfolios and asset, \( \sigma_{im} \) indicates the covariance between asset \( i \) and the market portfolio. As seen, risk is measured by the standard deviation about the mean. \( E(.) \) is an expectation operator and \( x \) is the share of assets invested in portfolio \( p \).

In order to find the relationship between risk and return for a risky asset \( i \), we need to find the contribution of a marginal investment in asset \( i \) to the expected return and riskiness of inefficient portfolio \( p \). This can be achieved by differentiating the equations (3.1) and (3.2) with respect to \( x \) as follows:
\[ dE(r_p) / dx = E(r_i) - E(r_m) \] \hspace{1cm} (3.3)

\[ \frac{d \sigma_p}{dx} = \frac{x \sigma_i^2 - \sigma_m^2 + x \sigma_m^2 + \sigma_{im} - 2x \sigma_{im}}{\sqrt{x^2 \sigma_i^2 + (1-x)^2 \sigma_m^2 + 2x (1-x) \sigma_{im}}} \] \hspace{1cm} (3.4)

After dividing the equation (3.3) by equation (3.4) and setting \( x = 0 \), the expression for \( dE(r_p) / \sigma_p \) will be obtained as:

\[ \frac{dE(r_p)}{d\sigma_p} = \frac{[E(r_i) - E(r_m)] \sigma_m}{\sigma_{im} - \sigma_m^2} \] \hspace{1cm} (3.5)

Since the price of risk must be equal for all assets and portfolios in the market in equilibrium, the equation (3.5) must also be equal to the slope of the capital market line (CML), which represents the price of risk in the market. Therefore, the following relationship holds in equilibrium:

\[ \frac{[E(r_i) - E(r_m)] \sigma_m}{\sigma_{im} - \sigma_m^2} = \frac{E(r_m) - r_f}{\sigma_m} \] \hspace{1cm} (3.6)

where \( r_f \) represents the risk-free rate of return. By arranging the equation (3.6) to provide an expression for the return on a risky asset \( i \), we will obtain the following equation, which is also called the security market line (SML):
Equation (3.7) indicates that the expected return on a risky asset is equal to the risk-free return plus a risk premium. It is known as the *Capital Asset Pricing Model* (CAPM). A risk premium is composed of two terms. The first term, $\sigma_m / \sigma_m^2$, is called the beta, $\beta$, value of stock $i$ and shows the amount of company $i$'s systematic risk relative to that of the market portfolio. The second term indicates the excess return on the market portfolio. Briefly, the CAPM expression given in equation (3.7) provides the relationship between a stock's systematic risk (relative to the market's systematic risk) and its expected return.

Considering the fact that the determinants of shares return in the CAPM equation is related to the determinants of risk, we need to have a close look at the sources of risk to get some insights into how these risk factors are represented in the CAPM. To this end, we will present the CAPM equation used in applied work as follows:

$$
r_i - r_f = \beta_i (r_m - r_f) + e_i
$$

Equation (3.8) provides more intuition in terms of understanding the underlying risk factors in determination of asset returns. As the equation indicates, an excess return on asset $i$ is the total of systematic and unsystematic risk. The unsystematic risk, represented by $e_i$ in the equation, is related to company specific factors (such as the quality of its management, the level of the research and development) and can be eliminated by holding an efficient portfolio. The systematic (or market) risk, however,
cannot be diversified away because it arises from unexpected changes in macro-
economic factors (such as unexpected changes in inflation, exchange rates, oil prices,
industrial production) which affects all firms in the same way (but to different extents).

It is worth noting that although the macroeconomic factors do not appear in the
CAPM expression, they are embedded into the market portfolio. In other words,
macroeconomic factors are modelled implicitly in the CAPM and represented by the
market portfolio. To clarify the latter point, it is important to note that the market
portfolio assumed in the CAPM expression is composed of all the assets in the
economy. This means that the market portfolio comprises all the information about
macroeconomic factors (which are the sources of systematic risk), but not about
company specific information, because this information is diversified away once we
have an efficient market portfolio. For the market portfolio to represent adequately
this information, it has to comprise all assets in the economy. If this is true, then the
beta reflects the true riskiness of an investment on a risk asset. Otherwise, for those
industries that are under-represented in the market portfolio, the beta values will be
biased because the market portfolio would not have sufficient information on the
macroeconomic risk factors related to these industries and could not price the
systematic riskiness of these companies fairly. However, it is difficult to measure the
market portfolio as defined in theory and this raises questions about the results of
CAPM studies. The problems related to the market portfolio were also the basis of the
famous Roll’s critique and gave rise to the development of the modern asset-pricing
model, Arbitrage Pricing Theory (APT). We first present a discussion on the Roll’s
critique and then provide a review of the APT in the next section.
Roll’s Critique of the CAPM

Roll (1977)’s critique did not focus on the theoretical foundation of the CAPM but questioned the validity of the common empirical investigation procedure regarding how well CAPM fits the actual data. However, the implications of his critique went beyond the empirical robustness of the CAPM results and led to the development of a new asset-pricing theory APT which is based on less restrictive assumptions than the CAPM. In his influential paper, Roll suggests that the correct and unambiguous test of CAPM has not appeared in the literature, and that is unlikely that such a test will be available in the future. “Testing the two-parameter asset-pricing theory is difficult (and currently unfeasible) due to a mathematical equivalence between the individual return beta-linearity relation and the market portfolio's mean variance efficiency, and a valid test presupposes complete knowledge of the true market portfolio’s composition. This implies, inter alias, that every individual asset which must be included is a correct test” (Roll, 1977).

Roll’s central point shows that the market portfolio is immeasurable. The market portfolio contains all marketable and non-marketable assets. He stresses that infrastructures about CAPM validity are sensitive to correct specification of the market index portfolio. He concludes that the traditional single factor CAPM is not testable until the exact composition of the true market portfolio is known and measured in an empirical test. Even then, the only hypothesis that can be tested is whether the market portfolio is mean-variance efficient. Therefore, using proxies for the market portfolio, such as the stock market index, involves problems. If the proxy
chosen is ex post mean-variance inefficient, the efficient set mathematics predicts that the CAPM relationship will not hold. However, if the performance is a measure relative to a proxy that is ex post efficient, then there is no security. Any realised abnormal returns just mean that the chosen market index is not ex post efficient. Thus, the regression of returns on betas will be perfectly linear. In short, Roll does not contest the internal validity of the CAPM. Rather, he exposes a fundamental problem of the CAPM model when it is applied to empirical research. He argues that the test of CAPM must be interpreted with caution.
3.3 THE ARBITRAGE PRICING THEORY

The second theory that provides a rigorous foundation for computing the trade-off between risk and return is the *Arbitrage Pricing Theory* (APT), which was formulated by Ross (1976). The APT is claimed to offer a testable alternative to the capital-pricing model and to be more general than the CAPM in accommodating several sources of systematic risk. It emphasises the co-variability of an asset's return with the risk factors in the return generating process rather than with the market portfolio (as the CAPM does). The general conclusion of the APT is that while the return on a particular asset is determined by systematic economic news, bearing diversifiable risk earns no extra reward. To this end, the APT states that, under certain assumptions, the expected return on any risky asset is approximately linearly related to its associated systematic risk factors. The assumptions employed in the derivation of the APT are as follows:

1. Investors are risk averse and prefer more return to less;
2. The capital market is perfectly competitive and frictionless – there are no restrictions on short selling, taxes, or transaction costs;
3. There are no arbitrage opportunities; and
4. All investors have homogenous expectations that the stochastic properties of asset returns are consistent with a linear structure of \( k \) factors.
The actual return on \( i \text{th} \) asset, then, takes the following general form:

\[
  r_{it} - E(r_{it}) = \beta_{ik}f_{kt} + \ldots + \beta_{ik}f_{kt} + \varepsilon_{it} = \sum_{k=1}^{n} \beta_{ik}f_{kt} + \varepsilon_{it} \tag{3.9}
\]

where,

- \( r_{it} \) = the random rate of return on the \( i \text{th} \) asset in period \( t \)
- \( E(r_{it}) \) = the expected rate of return on the \( i \text{th} \) asset in period \( t \)
- \( \beta_{ik} \) = the sensitivity of the return on asset \( i \) to the fluctuations in factor \( k \)
- \( \varepsilon_{it} \) = the "unsystematic" risk component to the \( i \text{th} \) asset assumed to be mutually independent over time and negligible for large numbers
- \( f_{kt} \) = unobservable common factors that influence the return on all assets under consideration in period \( t \).

It is also assumed that,

\[
  E(\varepsilon_{it}) = 0 \tag{3.10}
\]

\[
  E(f_{kt}) = 0 \tag{3.11}
\]

\[
  E(\varepsilon_i, \varepsilon_j) = 0 \tag{3.12}
\]

\[
  E(\varepsilon_i, f_{kt}) = 0 \tag{3.13}
\]

\[
  E(\varepsilon_i^2) = \sigma_i^2 \tag{3.14}
\]
Under the assumption of (3.10) to (3.14), the equation (3.9) says that the difference between the realised (actual) return and the expected return on asset i’s is a linear combination of the realized factor returns, with its specific factor loadings weighted, plus its specific risk component. It is assumed for all assets $i = 1 \ldots n$, the common factor $f_k$ is the systematic component of risk, and $\varepsilon_i$ is the unsystematic component of risk unique to the $i^{th}$ security alone.

When the number of assets is sufficiently large, the risk-return relationship will be as follows:

$$E(r_i) = \lambda_0 + \lambda_1 \beta_{i1} + \ldots + \lambda_k \beta_{ik}$$

(3.15)

where,

$\lambda_0 =$ expected return on an asset with zero systematic risk

$\lambda_i =$ risk premium for the $i^{th}$ factor in equilibrium $i = 1, 2, \ldots, k$

Equation (3.15) shows that pricing relationship is the central conclusion of APT which means the assets’ expected returns are jointly based on the asset sensitivity coefficients and the common risk premier.

Roll and Ross (1980) stated that if there is a single factor, the APT pricing relationship will be a line in expected return and systematic risk space:

$$E(r_i) - \lambda_0 = \lambda_i \beta_i$$

(3.16)
They illustrate this relationship geometrically by giving simple examples (Figure 3.1): if assets 1, 2, and 3 are presently held in positive amounts in some portfolios, and if asset 2 is above the line which connect assets 1 and 3, then a portfolio consisting of 1 and 3 will lower returns. In this case, it would be more logical for the investor to sell assets 1 and 3 and buy asset 2 instead. By doing so, any arbitrage opportunities will be unavailable when assets lie along a line.

Figure 3.1: Risk Return Relationship in the APT

As we can see, APT is mainly based on a no arbitrage condition in capital markets. In other words, the assumption of homogenous expectations and the law of one price determine the equilibrium return on the assets.
3.4 COMPARING THE APT WITH THE CAPM

After providing theoretical underpinnings of both CAPM and APT, we now present a brief overview of the arguments on the differences and similarities between these asset-pricing models. In comparison Ross (1976) argues that the APT is "substantially different from usual mean variance analysis and constitutes a related by quite distinct theory". He suggests there are two main differences when comparing these two models. First, the factors that affect actual and expected returns of assets are being modelled explicitly in the APT while CAPM focuses on the market portfolio. Second, the fact that in the APT the equilibrium relationship is derived is based on a no-arbitrage assumption.

Brealey and Myers (1999) suggest that the market portfolio that plays such a central role in the capital asset pricing model does not feature in arbitrage pricing theory. Likewise, Roll and Ross (1980:1080) argues, "In CAPM, it is crucial to both the theory and the testing that all universally available assets be included in the measured market portfolio. By contrast, the APT, in principle, is tested by examining only subsets of the set of all returns." Moreover, Bower and Logue (1984) use utility portfolio returns in the period of 1971-1979, and estimate expected returns by the CAPM and the APT. They state that the APT tends to predict returns better than the CAPM, and this is seen in the explanatory power of the models. The APT shows higher $R^2$ and fits closer to actual returns. Chen (1983) also performed a direct comparison of the APT and the CAPM. His results show that the CAPM is misspecified and the missing priced information is picked up by the APT factors. As a result, "if investors are sensitive to more than one type of risk when choosing among
portfolios of equal return, then the APT is superior to the CAPM because the CAPM is one-dimensional in risk” (Copeland et al., 1988:224). Briefly, it has been argued that the APT was superior to the original CAPM (Copeland et al., 1988:222) because:

- While both theories make the realistic assumption that investors prefer more wealth to less and that they are risk averse, the quadratic utility assumption of the original CAPM is much more restrictive.
- The APT does not require an assumption of multivariate normal distribution of returns.
- The APT does not require the existence of the market portfolio, therefore the difficulties such as identification of the market portfolio or a suitable proxy and the requirement that it be mean-efficient, are avoided.
- The APT does not require the existence of risk-free asset and a risk-less rate at which lending and borrowing are undertaken.

In summary, proponents of the APT propose the APT as a testable alternative to the CAPM because it is free of the restrictive assumptions of the CAPM and overcomes the difficulties related to our inability to observe the exact composition of the true market portfolio. They conclude, therefore, that the APT is fundamentally different from the CAPM. However, both of these arguments are not without critics.

Shanken (1982, 1985) challenges the view that the APT is inherently more susceptible to empirical verification than the CAPM. He argues that the APT relationship is an approximation, which only holds for a large number of assets and which prices these assets well. However, for a finite set of assets, it allows arbitrarily
large deviations from exact pricing. Although the APT relationship holds for a large number of assets, testing APT involves joint hypothesis that cannot be verified without observing the market portfolio. In this sense, a form of Roll's critique is applicable to the equilibrium APT.

On the second point mentioned above, Wei (1988) shows that the ex post and ex ante aspects of the CAPM and APT can be combined into a testable equilibrium-pricing model. To achieve this, he illustrates that it is only necessary to add the market portfolio as an extra factor to the APT model. The good thing about this formulation, he argues, is that it allows for some factors to be omitted from an econometric model utilised in testing the theory. If all of the factors are omitted, the model reduces to the CAPM. Furthermore, the importance of the market portfolio depends upon the number of omitted factors.
3.5 DETERMINANTS OF STOCK RETURN LITERATURE REVIEW

Empirical work on asset pricing aims to measure the extent to which company returns are related to systematic risk factor(s), which can then be used in financial decisions and an evaluation of the performance of stocks. It also aims to test the applicability of different asset-pricing models for explaining the change in stock prices and to test the usefulness of models for the identification of the underlying risk factors. As discussed in the previous section, there are two theories related to asset-pricing that can be employed to achieve these objectives. The first one is the CAPM, which states that the systematic risk measured by beta is the only factor that determines the expected return on an asset. As mentioned before, the information on the systematic risk factors is embedded into the market portfolio in the CAPM and therefore, the risk factors are implicit in this model. Second is the APT which assumes that systematic risk needs not to be implicit and represented by a single common factor as in the CAPM. Instead the expected return on assets is generated by the linear (K) factor model. However, one of the major shortcomings of APT is that it offers no theoretical or empirical grounds for identifying the economic nature of the factors or the methodology that should be used to estimate them.

In the rest of this section, we first provide a brief overview of the empirical literature on the CAPM and discuss the implications of the findings of this literature for the determinants of asset-pricing. Then, we provide the empirical literature on the APT. Considering the importance of identifying risk factors in the APT; this section will review the most common approaches in selecting factors and the relationship between these factors and asset return.
3.5.1 Empirical Evidence on the CAPM

Since it was developed by Sharpe (1964) and Lintner (1965), the CAPM model is widely used in evaluating the performance of portfolios and in estimating the relationship between risk and return. In contrast to its wide use in practice, the empirical record of the model is poor. The inability to observe the true market portfolio of assets plays a central role in its observed poor performance. In this subsection, first, we will provide the main approaches employed in an empirical analysis of CAPM. Then, we will present the findings of empirical studies on CAPM and discuss their implications for the evaluations of the performance of stock and for the determinants of asset pricing in stock markets.

Applied work on CAPM involves time-series and cross-section analysis of the stock market data. While the objective of the time-series approach is to estimate $\beta_j$ for each asset and to investigate how well the CAPM model fits the data, the cross-section approach aims at estimating the expected excess return on the market portfolio using average excess returns and estimates of $\beta_j$ coefficients for each asset. It is worth noting that our review of the empirical literature focuses on the time-series tests of the CAPM. The CAPM model used in empirical analysis can be written as follows:

$$ r_{it} - r_f = \alpha_i + \beta_i (r_m - r_f) + \varepsilon_{it} \quad (3.17) $$

where,

$$ r_{it} - r_f = \text{the excess return on asset over the risk free rate,} \quad (3.17) $$
\[ \alpha_i = \text{the intercept which should be equal to zero,} \]

\[ \beta_i = \text{a measure of the extent to which the return on asset is expected to move with the return on the market portfolio, and,} \]

\[ \epsilon_u = \text{an error term that shows the extent of unsystematic risk related to asset } i. \]

From equation (3.17), the implication of testing the CAPM can be summarised as follows: (1) the intercept term \((\alpha_i)\) should not be significantly different from zero (otherwise there may be something captured by the empirically stated intercept); (2) the beta, \(\beta_i\), should be the only factor that explains the rate of return on a risky asset; (3) the coefficient of beta (in cross-section regressions) is equal to the difference between the market portfolio return and the rate of return on the risk-free rate; (4) because the market portfolio is riskier, on average, it should have a higher rate of return than the risk-free rate.

Over the years, however, empirical tests of the CAPM have been conducted extensively by a number of researchers. The time-series regressions were first applied by Friend and Blume (1970), and Black, Jensen and Scholes (1972), and this method has become standard in testing the CAPM model. Most of studies carried out later on followed the technique developed by Black, Jensen and Scholes. They noted that if the CAPM holds, the intercept term in equation (3.17) is zero for all assets \(i\).

Black, Jensen and Scholes (1972) showed that the empirical market line is linear with a positive trade-off between return and risk. However, the intercept term is significantly different from zero indicating the rejection of the CAPM. Specifically,
they found that the intercept estimates in equation (3.17) are positive and significant for low beta portfolios, and negative for high beta portfolios. Fama and Macbeth (1973) confirmed their findings in cross-section regression tests. They found that the relationship between expected return and beta is linear and beta is the only measure of risk needed to explain differences in expected returns. However, they found evidence that the intercept is more than the risk-free asset.

The empirical evidence, that intercept is different from zero in time-series regressions and higher than risk-free rate of return in cross-section regression, indicate that some other factors besides relative systematic risk play a role in determining the asset returns. Later work on empirical analysis of CAPM concentrated on searching for these factors. Empirical evidence obtained from cross-section regressions shows that the information related to stock-price ratios is not captured adequately by betas: earning-price ratios (Basu, 1977), market capitalisation (Banz, 1981), debt-equity ratios (Bhandari, 1988) and the book-to-market ratio (Statman, 1980 and Rosenberg, Reid and Lanstein, 1985). Similar results are reached by Fama and French (1996) for time-series regressions. Then, the empirical literature turns to possible explanations.

One explanation given in the literature is that these surprising results are due to data dredging.

Another one is related to the CAPM’s assumption that investors care only about the mean-variance distribution of return. Fama and French (2003) argue that because investors also care about the covariances between their portfolio returns and macroeconomic factors, variance of a portfolio’s return cannot adequately accommodate the important dimension of risk.
The third possible explanation for the CAPM anomalies, which is also closely related to the second reason mentioned above, is due to bad proxies for the market portfolio. This is exactly what Roll’s criticism of CAPM discussed above. The CAPM theory specifies the market portfolio as the one that should include all risky investment like human capital, private investments, and private real estate. However, empirical research on CAPM employs stock market indices as a proxy for the market portfolio, which is restricted to common stocks. This means that our measure of the market portfolio cannot represent adequately the price of risk in the market and hence the riskiness of a particular company. Although Stambaugh (1982) argued that the CAPM results are more sensitive to the selection of asset than to the composition of the market index, Fama and French (2003) conclude that there is no solution to the market proxy problem and because of this the CAPM models employed in practice to estimate expected return would make systematic and predictable errors.

In summary, the empirical literature on the CAPM indicates that company risk measures obtained from CAPM regressions may not be the robust estimates of $\beta$’s. This is not because of the problems related to the theoretical foundations of the CAPM, but rather related to the inability to observe the market portfolio. This has important implications for a research that aims to evaluate the determinants of stock-price changes in an oil-based country like Saudi Arabia’s. It is possible that an asset-pricing model that takes explicit account of the systematic risk factors in its modelling framework would provide robust measures of risk for companies. The arbitrage pricing model might be such an alternative to the CAPM. In the next section, we provide a review of empirical studies on the APT and discuss how the risk factors are identified and selected in practice.
3.5.2 Empirical Review of the APT Studies

The purpose of this section is to review the existing empirical literature on the APT model giving special attention to the identification of macroeconomic risk factors. As discussed in the theoretical literature section, the APT model, which is based on the arbitrage principle, explains stock returns as a function of macroeconomic (systematic) risk factors in addition to, or instead of, the market rate of return. Empirical work on the APT involves both time-series and cross-section studies of rates of return, as was the case for the CAPM. However, the theory does not specify exactly what the systematic risk factors are or how many such factors exist. But we know from the finance literature that systematic risk arises from unanticipated changes in the macro-economic variables. Most of the studies on the literature focused on identifying these factors. Examinations of the empirical literature show that three different strategies are followed in the identification of these factors and an estimation of the APT model in practice: (1) risk factors are determined using statistical techniques such as factor analysis or principle components; (2) different well-diversified portfolios (such as small and large capitalisation portfolios) are substituted for these factors; (3) macro-economic and financial variables, which are selected based on economic theory and the knowledge of financial markets, are used as factors.

Although each of these approaches has its merits, the third approach seems to provide an intuitively appealing set of factors that simplify the interpretation of the risk exposures. Furthermore, the third approach allows us to use economic information in addition to stock returns leading to better estimates, whereas the first
two approaches use stock returns to explain stock returns. For these reasons, it is worth noting that, in our empirical analysis, we will employ the risk factors identified by the economic theory. To this end, in the rest of this sub-section, we first provide a brief review of the empirical studies on APT, which make use of factor analysis. Then, we will provide a detailed review of the empirical studies employing predetermined risk factors. In it, we will show the theoretical reasons for choosing these factors, which will be very useful when we interpret the results of our applied work in the following chapters.

**Empirical Test of APT using Factor Analysis**

Factor analysis is used only as a statistical tool to uncover the underlying factors in the economy by investigating how asset returns co-vary together. The problem of the factor-analysis approach is related to the number of common factors and their association with macroeconomic variables, which would help in their economic interpretation. Roll and Ross (1980) acknowledged Gher (1975) as the first study to test APT in his study of stock price data from 24 industry indexes and 41 individual stocks. Roll and Ross used daily returns data of NYSE and AMEX companies listed on the exchange from 1962 to 1972. They employed factor analysis to analyse 1260 NYSE stocks that were divided into 42 groups of 30 stocks. Their study was conducted in the following way:

- For each stock group a sample co-variance matrix was computed;
- To estimate the number of factors loading a maximum likelihood, factor analysis was performed;
• The estimated individual asset-loading was used to explain the cross-sectional variations of individual estimated expected returns via the cross-sectional generalized least-squares; and
• Estimates from the cross-sectional model were used to measure the risk premium associated with the estimated factors.

Roll and Ross concluded that when the risk-free coefficient $\lambda_0$ is assumed to be 6% per annum during the sample period, 88.1% of the groups have at least one significant factor-risk premium, and 57% have two or more significant factors. In one third of the groups at least, three risk-premium factors were significant when the intercept $\lambda_0$ was estimated. Using data for individual securities during the period 1962-1972 periods, they found that there are at least three important factors for asset pricing and that it is unlikely these factors will exceed four.

They also introduced the standard deviation of individual returns as the explanatory variable to find out if other variables are also priced, even though they are not related to undiversifiable risk. They found that the apparent significant explanatory power of the “own” standard deviation is due to positive skewness and that, in fact, this variable does not improve the explained variation on returns. In order to find out whether the factors found for each group are different or not, they checked the intercept term and found no evidence that the intercept term is different. As can be seen, these results strongly support APT.

Chen (1983), using factor analysis and forming a portfolio, tested APT and compared it with CAPM by using daily stock returns from 1963-1978. In Chen’s
opinion the CAPM appeared to the econometrically misspecified, and that the APT model was able to explain some of the CAPM’s unexplained residual returns. In contrast, he suggested the CAPM was unable to explain the error term from the APT model. In conclusion, Chen found that the APT’s performance is more reliable than CAPM’s.

Cho, Elton and Gruber (1984) examined both the validity of the APT and the study of Roll and Ross (1980). They claimed that very little is known about the properties of the estimates obtained from maximum-factor analysis or of the sensitivity of the result when studying characteristics of the underlying data. They had been able to examine the results of the return-generating procedure used by Roll and Ross (1980), and once they had allowed for changes over time in the parameters of this process, they concluded that equilibrium returns can generally be explained by two factors.

Benstooock and Chan (1986) tested APT by using UK security returns; they found that a relatively high proportion of the variance of estimated expected returns for 220 UK securities could be explained in terms of APT. They concluded that the explanatory power of a 20-factor APT model is significantly greater than a 4-factor model. They also noted that the number of factors is proportionate to the sample size. Yli-olli and Vertanen (1992) tested APT on Finnish securities using transformation analysis to determine the stability of the factor structure over time. They concluded that two factors were strong and two factors were relatively significant. Also, as an extension of APT, Yli-olli and Virtanen (1992), studied Finnish securities and two common factors were found.
Dhrymes (1984) used a sample similar to that of Roll and Ross (1980), and concluded that:

"at the 5% level of significance, with a group of 15 securities, we have at most two 'common risk' factors; with a group of 30 securities we have at most three 'common risk' factors; with a group of 45 securities we have at most four 'common risk' factors; with a group of 60 securities we have at most six 'common risk' factors; and with a group of 90 securities we have at most nine 'common risk' factors".

There exists a significantly positive relationship between the number of factors, which affect the security returns, and the number of securities in the groups to which the factor analytic methods are applied. The number of securities being analysed has an impact on the number of "common risk" factors being discovered. Such results highlight the fact that the methodology used for testing APT may not be the appropriate one and those previous tests of APT are not necessarily a valid test of the model.

In another study, Dhrymes, Friend, Gultekin, and Gultekin (1985b) used new procedures to test the basic implication of the APT model that only common (factor) risks are priced. The common and unique variance measures are estimated within the sample period in which they serve as explanatory variables. Common and unique measures of risk derive from the daily time-series observations in the first half-period (1962 to 1972) and are used to explain the daily cross-section returns for the second half-period (1972 to 1981). The quartet was concerned about the question of how the numbers of factors that are significant (on the first stage) and/or priced (on the second
stage) vary with the size of the securities groups or the length of the time series. Their
test results appeared to be extremely sensitive to the number of securities used in two
stages of the test of the APT model. The tests also indicated that unique risk was fully
as important as common risk.

Furthermore, although there are various theories that propose links between
macroeconomic variables and stock returns, Chen, Roll and Ross (1986), and
Boudoukh and Richardson (1993) stated that macroeconomic variables are often used
as proxy for pervasive risk-factors in the context of APT models.
3.5.3 Economic Forces Affecting Stock Returns

As mentioned above, another widely used approach used to select factors is to specify factor apriority. In this way, some firm characteristics, macro-economic variables or specific sets of portfolios can be used as factors. The primary advantage of this approach is that the factors and their APT prices, in principle, can be given interpretation while in the factor-analysis approach it is unknown which factors are being priced. The problem with this approach is the selection process of these factors. Their selection usually comes from economic theory intuition. This approach of selecting factors is widely covered in the literature, for example, by Chen, Roll and Ross (1986), McElroy and Burmeister (1988), and Hamao (1989). A number of important macroeconomic variables are identified as risk-factors in the literature. We now look at these factors below.

Oil Prices

Recently, the impact of oil prices on financial markets and stock prices has been paid a lot of attention. This is mainly because oil expenditures account for a relatively large proportion of GDP in most countries, and oil prices have potentially important implications for the cost of factor inputs for many companies. In this sense, it is expected that oil price sensitivity will be high for the industries which use oil-based inputs extensively and oil explains a relatively high proportion of their costs such as transport. However, it is difficult to detect the full impact of oil price changes on company returns because the oil-price sensitivity of firms is closely related to the
extent to which firm's hedge against oil-price risk and their ability to reflect their costs to consumers through changing goods prices.

Several studies have examined the relationship between oil prices and business-cycle fluctuations. For example, the early study of Hamilton (1983) observed that seven of the eight post-war recessions in the United States have been preceded by a dramatic increase in the price of oil. Hamilton also found a strong negative relationship between oil-price changes and GNP growth when using a multivariate vector auto-regression (VAR) system. Gisser and Goodwin (1986) tested three notions associated with energy crisis:

1. that the impact of oil price shocks is largely in the form of cost-push inflation;
2. that crude oil prices affected the macro economy differently before and after 1973; and
3. that the factors determining crude oil prices post-1973 are now different from those obtaining pre-1973.

Gisser and Goodwin concluded that oil prices have both real and an inflationary effect. They found no evidence of a dramatic break in the way oil prices affected the macro economy after the OPEC embargo of 1973. Finally, they found evidence that, before 1973, the rate of inflation was strongly informative about the future course of oil prices, but that after that time a broader array of indicators of the U.S economy were weakly informative. Raymond and Rich (1997) analyzed the relationship between oil-price shocks and post-war U.S. business cycle fluctuations. They developed a generalized Markov switching model of output that included a
measure of net real oil-price increases and examined the capabilities of the variable to generate shifts in the mean of GDP growth, and to predict transitions between dichotomous growth phases. Their result indicated that while the behaviour of oil price has been a contributing factor to the mean of low-growth phases of output, movements in oil prices generally have been regarded as principal determinants in the historical incidence of these phases.

As we have seen, numerous studies relate oil prices to the macro economy and business cycle, which consequently affect the performance of stock markets. On the other hand, studies in the finance literature that directly investigate the relationship between stock market and oil are scarce. Jones and Kaul (1996) tested whether stock prices reacted rationally, or overreacted to changes in oil prices in four countries: the U.S, Canada, Japan and the U.K. They used using the standard cash-flow dividend-valuation model. Following Campbell (1991), they estimated the following regression:

\[ R_{St} = E_{t-1}(RS_t) + (E_t - E_{t-1}) \sum_{j=0}^{\infty} p^j \Delta c_{t+j} - (E_t - E_{t-1}) \sum_{j=0}^{\infty} RS_{t+j} + \sum_{s=0}^{k} \theta_s Oil_{t-s} + \eta_t \]  

(3.18)

where,

- \( E_t \) = the expectation formed at the time \( t \),
- \( c_t \) = the log of the real cash flow in period \( t \),
- \( p \) = parameter close to but less than one,
- \( RS_t \) = the log real return on stock in period \( t \),
- \( Oil_t \) = the percentage change in oil prices in period \( t \), and
- \( k \) = arbitrarily chosen parameter.
Their investigation of the relationship of the U.S and Canadian stock markets to oil shocks showed that stock prices in both markets rationally reflected the impact of the news on both current and future real cash flows. In the case of Japan and the U.K., they were unable to explain completely these stock markets’ reactions to oil prices changes within the context of a rational asset-pricing framework. While oil shocks in Japan and the U.K led to changes in stock prices, it appeared that these changes are substantially greater than could be justified by the effect of these shocks on subsequent real cash flows. They concluded that, in the case of Japan and the U.K, either oil shocks have an impact on expected stock returns in a way that is not captured by their proxies for the expected returns, or these stock markets simply overreacted to oil prices shocks.

Other studies used oil prices in addition to other economic variables. For example, Chen, Roll and Ross (1986) found that oil prices are not separately rewarded in U.S. stock prices. Ferson and Harvey (1993) investigated the sources of risk and predictability of international equity market returns using equity returns for 18 national markets provided by Morgan Stanley Capital International (MSCI). Constructing a set of variables to represent global risks, including the change in the monthly average U.S dollar price per barrel of crude oil, they concluded that the largest component is the time-varying risk premium.

Faff and Brailsford (1999) investigated the sensitivity of Australian industry equity returns to an oil price over the period 1983-96. They employed the CAPM model augmented by an oil-price factor to establish whether changes in oil prices
exhibit a systematic risk on equity returns over and above the influence of market returns. They have found that while oil and gas and diversified resources industries have a statistically significant positive sensitivity to the oil price factor, paper and packaging, transport and banking industries have a statistically significant negative sensitivity to the oil price factor. They explained the finding of both positive and negative effects on an industry base arguing that analysis at the aggregate market level may hide industry sector effects.

**Inflation**

According to the Fisher hypothesis applied to common stock, the (ex ante) real rate of return on a portfolio of common stocks is defined by the following equation:

\[ \alpha_t = \mathbb{E}(R_t / I_t) - \mathbb{E}(P_t / I_t) \]  \hspace{1cm} (3.19)

where,

\[ \alpha_t = \text{ex ante real rate of return}, \]

\[ R_t = \text{realized rate of return during period } t, \]

\[ I_t = \text{information available to the market at the beginning of period } t, \]

\[ E = \text{mathematical expectation operator}, \text{ and} \]

\[ P_t = \text{rate of inflation realized over period } t. \]

Irving Fisher's hypothesis states that \( \alpha_t \) is uncorrelated with the expected rate of inflation. This hypothesis has been widely accepted among financial economist and can be generalized to rates of return on every asset including common stocks.

Contrary to this, several studies carried by Lintner (1975), Fama and Schwert (1977),
Nelson (1976) Jaffe and Mandelker (1976) and Body (1976) found a negative relationship between stock return and expected/unexpected inflation. This anomalous relationship observed between stock-return and inflation was a concern for several researchers. Fama (1981) based his explanation on the hypothesis that this negative relationship is proxying for positive one between stock return and real variables, which are more fundamental determinants of shares value. Fama suggested that the stock-return relationship is induced by the relationship between inflation and real activity, which in turn, is explained by the monetary demand theory and the quantity theory of money. In his conclusion, Fama shows that the proxy-effect hypothesis implies that measures of real activity should dominate the measurement of inflation when both are used as explanatory variables in real stock-return regressions. In monthly, quarterly, and annual data, growth rates of money and real activity eliminate the negative relationships between real stock-return and expected inflation rates. In the annual stock-return regression, unexpected inflation also loses its explanatory power when placed in competition with future real activity. Chen, Roll, and Ross (1986) defined three variables related to inflation.

Firstly, expected inflation obtained from Fama and Gibson (1984) and defined as:

\[ E \left[ I(t) / t-1 \right] = TB(t-1) - E \left[ RHo(t) / t-1 \right], \]  
(3.20)

Secondly, unanticipated inflation defined as:

\[ UI(t) = I(t) - E \left[ I(t) / t-1 \right], \]  
(3.21)

Thirdly, change in expected inflation defined as:

\[ DEI(t) = E \left[ I(t+1) / t \right] - E \left[ I(t) / t-1 \right] \]  
(3.22)
where,

\[ TB(t-1) = \text{treasury bill rate}, \]
\[ E \left[ \frac{RHo(t)}{t-1} \right] = \text{expected real rate of interest}, \]
\[ I(t) = \text{realized inflation}. \]

Chen, Roll and Ross (1986) used monthly data for the period 1958-1984. In their conclusion they found: the relationship between the inflation related variables \( DEI(t) \) and \( UI(t) \) and stock return is a significantly negative relationship. Gesk and Roll (1983) argued that the puzzling empirical phenomenon between stock return and both expected and unexpected inflation does not indicate causality. Instead, stock returns are negatively related to contemporaneous changes in expected and unexpected inflation because they signal a chain of macroeconomic events. These events were explained by Gesk and Roll in three steps.

First, the government’s principal revenues are personal and corporate taxes. When stock prices change in response to anticipated changes in economic conditions, personal and corporate incomes change in the same direction, inducing similar change in government revenue. Thus, fluctuations in government revenue are closely related to stock market movements.

Second, if government expenditures do not accommodate themselves to change in revenues, fluctuations in revenue will be reflected in deficits.

Third, when a deficit occurs, the treasury is obliged to borrow. In recent years, the U.S. Federal Reserve System offset the deficit by monetizing the debt either by
printing money or by expanding bank reserves. This effectively generates the required surplus by indirect taxation through the inflation caused by an increase of monetary growth. Gesk and Roll concluded with data covering three decades. They examined every link in the causative chain described above and found supporting evidence in each case.

Solink (1983) provided empirical evidence on the relationship between stock return and inflationary expectations for nine countries over the period 1971-1980. Solinik's work provides consistent support for the Gesk and Roll model. He concludes that, without deciding on the "causality" direction, the link between inflation and stock return appears through inflationary expectations and more specifically from a revision in expectation. Gultekin (1983a) also investigated the relationship between common stock returns and inflation in twenty-six countries for the post-war period. He used three different estimates of the expected inflation rate.

First, he used the contemporaneous inflation rates of twenty-five countries for the period January 1947 – December 1979. Realized values were used under the assumption that expectations were rational. Rationality implies that the expectations of inflation and stock return in period \( t \) are based upon all relevant information available as of the beginning of period \( t \). Rationality also requires that prediction errors have zero means and are serially uncorrelated.

Second, he decomposed inflation into expected and unexpected components by using procedures developed by Box and Jenkins (1970). An inflation forecast from ARIMA
models was used as an estimate of expected inflation and the forecast error was used as the unexpected component of inflation rates.

Third, short-term interest rates were used as predictors of inflation by employing Fama's technique to predict quarterly inflation rates from ninety-day Treasury Bills or their equivalent money market returns. He concluded that the relationship between stock-return and inflation is negative. Furthermore, he found that stock-return inflation is not stable over time and that there are differences among countries. Gultekin (1983 b) also examined the Fisher hypothesis as a model relating expected stock return and expected inflation. He used data from Livingston's survey of expectation instead of realized stock market returns and inflation as proxies for the expected counter-part. He found that the Fisher equation holds much better for ex ante expectation than for ex post realizations. Hasbrouck (1984) used expectation data from Livingston and other sources to study the empirical relationship between stock returns, inflation and economic activity. The main empirical findings of this work were as follow:

1. the hypothesized relationship between expected economic activity and expected inflation does not in practice appear to be important in explaining the negative relationship between expected inflation and stock returns;
2. the survey data used do lend support to the hypothesis of a quantity theory relationship between expected inflation and expected economic activity, holding constant monetary growth; and
3. the cross-forecaster dispassion of economic activity which forecasts, a proxy of real uncertainty, appears to be a significant determinant of stock returns.
Kaul (1987) showed that the stock-return inflation relationship very systematically over time depends on the influence of monetary demand and supply factors: specifically, the monetary demand effect, combined with a counter-cyclical monetary response, leads to a negative stock-return inflation relationship.

Kaul (1990) conducted another study to analyze the impact of changes in monetary policy regimes on the relationship between stock return and expected inflation/changes in expected inflation in the post-war period. He used data from four developed countries – the U.S.A, Canada, U.K., and Germany – and identified monetary policy regimes based on official statements by the monetary authorities in the four countries. The evidence from all four countries shows that the negative stock-return-changes in expected inflation relationships in the post-war period vary systematically across monetary regimes, and are significantly stronger during interest-rate regimes as compared to money-supply regimes.

Boudoukh, Richardson and Whitelaw (1994) investigated the cross-sectional relationships between industry-sorted stock returns and expected inflation. Using monthly data for the period 1953-1990, and sorting firms into twenty-two industry sectors, they used a model that captures both:

i. the cross sectional variation in these relationships across the industries; and

ii. the negative and positive relationship between stock return and inflation at short and long horizons respectively.
The model was developed in an economic environment in which the spirit of the Fisher model is preserved. They found that the relationship between industry-sorted stock returns and expected inflation is linked to cyclical movement in industry output. Stock returns of non-cyclical industries tend to vary positively with expected inflation while the reverse holds for cyclical industries.

Peac and Roley (1988) examined the effect of unanticipated inflation on the rates of return on individual stocks by considering characteristics such as inventory-accounting methods and pensions. They concluded that time-varying firm characteristics related to inflation predominately determine the effect of unanticipated inflation on stock rates of return. Moreover, the effect could be positive or negative. They also found factors like debt-equity ratios, inventory-accounting methods used by firms, and market betas are important in determining the response. Titman and Warga (1989) examined whether a trawl of stock returns could provide forecasts of change in interest-rational inflation for the period 1979-1982. Their research showed a positive relationship between stock return and future inflation changes during the period covered. Santoni and Moehring (1994) raised the question of validity of the index used to measure inflation. They compared a price index based on wealth-like magnitudes to current service flow price indices like CPI and the GNP dilator, and different measures of the price level to the problem of estimating asset returns. They concluded that the selection of indices could yield inappropriate estimates of the rate of inflation for problems concerning the measurement of asset return where it this necessarily the ease that people choose between present goods with lives extending in to the future.
**Interest Rates**

Asset prices are basically determined by the future cash flow stream arising from the underlying asset and discount rates. Miller and Modigliani (1961) developed a simple framework for understanding the relationship between stock prices, the stream of future cash flows from stock and the discount rate. Assuming the required rate of return and the expected growth rate of dividends per share are kept constant over the future period, the dividend discount model presents the following relationship between stock prices and other variables:

\[
P = D \frac{1 + G}{1 + K} + D \frac{(1 + G)^2}{(1 + K)^2} + D \frac{(1 + G)^3}{(1 + K)^3} + \ldots
\]

(3.23)

where,

- \( P \) = stock prices,
- \( D \) = dividend per share,
- \( G \) = expected growth rate of dividend per share, and
- \( K \) = required rate of return for investor.

This equation can be written simply as:

\[
P = \frac{D}{K - G}
\]

(3.24)

or

\[
P = \frac{D}{I + R - G}
\]

(3.25)

where,
\[ I = \text{interest rate in the market and} \]
\[ R = \text{risk premium for stock investment.} \]

The previous formula shows that one of the most important parameters in determining stock price is the value of interest rates in the market. A rise in interest rates will reduce the present value of future cash flows, which investors expect to receive in the form of dividend and capital gains. However, we can look at this from a different perspective for higher interest rates make the rate of return on the debt instrument relatively more attractive to investors. This can reduce the demand for shares and lower their prices.

In finance literature there is a wide range of studies that cover the relationship between stock returns and interest rates or related variables such as term structures of interest and discount rates. Flannery and James (1984) studied the effect of interest rate changes on the common stock return of financial institutions using a nominal contracting hypothesis which was first introduced by French, Ruback and Shewert (1983) and stated that firms with fewer nominal assets than nominal liabilities should benefit from unanticipated inflation. They concluded that for commercial banks stocks, changes in interest rates were found to be significantly related to stock price movements.

Sadeghi (1992) examined the relationship between stock-return interest rates in Australia using data on expected changes in interest rates collected from survey forecasts and estimated through the ARIMA procedure. He found a negative relationship between stock returns and interest rates but noted that the coefficient was
not significantly different from zero. This was due in his belief to heavy government intervention in the money stock market to control interest rates. However, the impact of interest rates on the portfolio of the industrial and resource sector shares is less significant than on the market portfolio.

Blanchard (1981) developed a simple model for the determination of output, the stock market and the term structure of interest rates. The model is an extension of the IS-LM model and borrows from it the assumption that output is determined by aggregate demand, and that the price level can only adjust over time to its equilibrium value. However, whereas the IS-LM emphasizes the interaction between the interest rate and output, the Blanchard model emphasizes the interaction between asset value and output. Asset values, rather than the interest rate, are the main determinants of aggregate demand and output. In this conclusion, Blanchard shows the interaction between output and stock market. The effect of a change either in current or anticipated policy is a discrete change in the stock market due to the change in the anticipated sequence of profit and real interest rates. This in turn, together with the change in policy, affects spending and output over time validates the initial anticipations of profits and interest rates. Also, he states that the stock market is not the cause of the increase in output, no more than increases in output are the cause of the initial stock-market change. They are both the result of changes in policy.

Kraft and Kraft (1977) tested the causal relationship between several determinants of stock prices; the determinants used are the money supply, the rate of change in the money supply, the corporate interest rate, and a measure of risk. They used Standard and Poor's composite-stock index (SP) for five hundred stocks as a
measure of the sum risk less the rate of interest and the risk premium. They concluded that the result of their work shows no causal relationship between Moody’s AAA corporate bond rate and other determinants used in common stock prices.

Titman and Worga (1989) examined whether lagged stock returns provide a fare cost of changes in both long-term and short-term interest rates during the November 1979 to October 1982 period and found a positive relationship. They questioned the positive relation hold in the 1979-1982 periods. They have two reasons for asking the question. The first was that interest rates were, somehow, more predictable in this period and hence their changes were more rapidly incorporated into stock prices. The second was that interest rate changes were more sensitive to changes in industrial output during this time. Changes in interest rates over the business cycle, therefore, have been more pronounced.

Finally, it is worth mentioning that some studies have focused on the relation between the discount rate (which is defined as the interest rate that feeds change when it is a loan to a bank) and stock returns. Smirlock and Yamits (1985), made another study, which focused on the relationship between stock returns and term structure (which is defined as the relationship between interest rates on bonds with different maturity terms). Chen, Roll, and Ross (1986), and Fama and French (1989) all found evidence of the response of financial markets to discount-rate and term-structure changes.
Money Supply

The nature of the relationship between the money supply and common stock prices was described in the work of Homa and Jaffee (1971) who viewed common stock as an asset that yields a return to the investor over time. The value of the share can be expressed in terms of the present discounted value (PDV) of the expected dividends:

\[ PDV_0 = \sum_{t=0}^{\infty} \frac{D_0 (1 + g_t)^t}{(1 + r_t + p_t)^t} \]

(3.26)

where,

- \( D_0 \) = the level of current dividends,
- \( g_t \) = expected growth rate of dividends at time \( t \),
- \( r_t \) = risk less rate, and
- \( p_t \) = risk premium.

Based on the above, an investor should be willing to pay a price equal to the PDV for any share. The price of common stock consequently will be determined by three variables: the level and the growth rate of dividends which are related positively to the money supply, a riskless rate of interest and the risk premium which is related negatively to the money supply.

According to Homa and Jaffee the main channel of influence of the money supply on dividends operates through a firm’s current and expected earnings. A decrease in the supply of money will raise interest rates and reduce interest-sensitive expenditures such as capital investment. The decrease in expenditure, together with
the standard multiplier, will then cause a reduction in the firm’s sales and thus a decrease in its earnings. Ultimately this will lead to a decrease in dividends and a fall in share prices.

The influence of the money supply on the riskless interest rate component of the investor’s discount rate is a direct function of the effect of the money supply on market interest rates. Moreover, the explicit increase in market interest rates caused by increased monetary tightness may be reinforced by credit rationing in the loan markets. In this case, monetary tightness will raise the discount rate by an amount greater than the rate indicated by the level of market interest rate alone would otherwise suggest.

The influence of the money supply on the risk premium of the investor’s discount rate is more difficult to quantify. The risk component arises because of the uncertainty associated with the future growth value of dividends and the level of the riskless interest rate. Assuming the investor is a risk averter, the risk premium will be positive, and it will be positively associated with increased uncertainty. The affect of monetary tightness on the risk premium thus must operate by increasing the uncertainty with which the investor’s expectations are held.

Hamburger and Kochin (1972) argued that these indirect relationships do not appear to be consistent with the evidence; and there should also be an important short-run impact on the stock market which is independent of the influence money has on interest rates and expected corporate earnings.
Kraft and Kraft (1977), using $M_1$ as the money variable in both the level and the percentage of change, tested the causal relationship between the money supply and the rate of change in the money supply. They concluded there was no causal relationship between the money supply, the percentage change in the money supply and common stock prices. Peasando (1974) evaluated the potential contribution of Hamburger and Kochin, Homa and Jaffee, and of the Keran models to the problem of forecasting the level of common stock prices. Using both Canadian and American data and then subjecting them to a series of tests designed to measure their structural stability and sensitivity to possible specification error, he concluded that these modules are unable to generate an accurate *ex-post* forecast of stock prices and provide deviator evidence of the model’s failure to capture a stable structural relationship. Pesando also added that these results suggest that one should not place undue confidence in the quantitative estimates of the impact of a fluctuation in the money supply on common stock prices.

Cooper (1974) provided a plausible framework for estimating the relationship between the money supply and stock-market returns. It was based on the SQ – EM model which is a combination of the *simple quantity* theory (SQ) model and the *efficient markets* (EM) model. The SQ – EM model suggests that the money supply may be an important factor in determining the market rate of return (consistent with SQ model) but that these returns may actually lead to money changes (consistent with EM model) since all variables’ information, such as anticipation about future money changes, are incorporated into current returns. In his conclusion, Cooper found that two important propositions can be established based on his work. First, stock returns lead money supply changes; they do not lag changes. Second, money supply changes
do appear to have an important effect on stock returns. The most plausible explanation of the relationship between money supply changes and stock returns according to Cooper is a combination of the efficient market model and the quantity theory of money.

Darrat (1990) studied the impact of monetary and fiscal policy on stock prices employing monthly data from the Montreal stock market index during the period 1972-1987. Darrat used the Multivariate Granger Causality test in conjunction with Akaike's Final Prediction Error (FPE) and the "specific gravity" criteria. His empirical estimates show that the current stock prices in Canada fully reflect all available information on monetary policy moves.

Jain (1988) examined hourly stock prices to investigate the response of the market participants to announcements about the money supply and other economic variables covering the period 1978 to 1984. The result of his study showed that money supply announcements have a negative impact on stock prices. The result also showed that most of the effect of new information on stock prices lasts for barely an hour or so. Also the examination of the possible effect of announcement across three regimes, in which the Federal Reserve exercised different levels of control on M1, indicated that the stock price response to a money supply announcement does not differ statistically across regimes.

Lili and Hu (1998) employed the Dow Jones Industrial Index, S&P 500, the Russell 100 and the Russell 2000 index systematically to examine stock market reaction to money supply and other economic variables news conditional on the state
of economy (i.e. expansion, recession, etc.). They concluded that it is the money supply which has the strong effects. These effects are roughly consistent with the inflation expectation hypothesis and the liquidity effect hypothesis.

**Exchange Rates**

The appreciation of the domestic currency with respect to foreign currencies reduces the competitive position of export industries by making their products more expensive to foreigners. This, in turn, reduces their profits and the value of their shares. Jorion (1990) analyzed the foreign exchange exposure of multinationals, an exposure which represented the sensitivity of the value of the firms concerned to random change in currency values. Jorion found a positive and reliable correlation between the value of U.S. multinationals with a degree of foreign involvement and exchange rates. These results have a direct implication for asset pricing given that the value of the dollar appears to be one factor that differentially affects U.S stock.

Jorion (1991) examined the pricing of foreign exchange risk in all outstanding NYSE stocks classified within a twenty-two-value weighted industry portfolio. He covered the period from January 1971, which is the year when the exchange rate started to float, to December 1987. He used two models. The first was a two-factor model that included the market and the exchange rate. The second was the Chen, Roll and Ross (1986) approach with six factors, presumably correctly specified, to include the exchange rate as an additional factor. The two models were estimated as follows.
First,
\[ \tilde{R}_u = \left[ \delta_0 (1 - B_i^v) + \delta_i B_i^v + B_i^m \tilde{R}_{mt} + B_i^r \tilde{F}_{st} + \tilde{E}_i \right] \quad (3.27) \]
\[ \tilde{F}_{st} = \tilde{R}_{st} - (\hat{\delta}_0 + \hat{\delta}_i \tilde{R}_{mt}) \]

Second,
\[ \tilde{R}_u = [\delta_0 + \sum_{j=1}^6 \delta_j B_j^i + \delta_i B_i^v] + \sum_{j=1}^6 B_j^i \{ \tilde{F}_{jt} - E(\tilde{F}_{jt}) \} + B_i^s \tilde{F}_{st} + \tilde{E}_i \quad (3.28) \]
\[ \tilde{F}_{st} = \tilde{R}_{st} - (\hat{\gamma} + \sum_{j=1}^6 \hat{\gamma}_j \tilde{F}_{jt}) \]

where,
\[ \tilde{R}_u = \text{excess returns}, \]
\[ \tilde{R}_{mt} = \text{the value-weighted stock market return}, \]
\[ R_{st} = \text{the rate of change in a trade-weighted exchange rate}, \]
\[ \tilde{F}_{jt} = \text{six risk factors that are defined in Chen, Roll and Ross (1986)}, \]
\[ B_i^s = \text{exchange rate exposure, and} \]
\[ \delta_i = \text{constant risk premium of exchange rate exposure.} \]

In his conclusion, Jorion showed first that U.S industries display significant cross-sectional differences in their exposure to movement in the dollar. Next, he showed that where the currency exposure of U.S firms was priced in the sense of Ross’s APT, in spite of using relatively powerful statistical techniques, there was a little evidence that U.S investors required compensation for bearing exchange risk.
Chow, Lee and Solt (1997) examined the exchange-rate risk exposure of U.S stock and bonds from March 1977 to December 1989 over one to forty-eight month horizons. They estimated exchange exposure from a time-series regression of domestic-currency denominated asset returns against actual exchange-rate changes. They used a regression model estimated for horizons \( T = 1, 3, 6, 12, 2, 36, \) and 48 months as follows:

\[
R_{t,t+T} = B_0 + B_1 X_{RTE_{t,t+T}} + B_1 X_t + B_2 TRPM_t + \epsilon_{t,t+T} \tag{3.29}
\]

where,

- \( R_{t,t+T} \) = the asset continuous rate of return in excess of the risk-free rate from \( t \) to \( t+T \),
- \( X_{RTE_{t,t+T}} \) = the continuous rate of change in a real exchange rate index,
- \( X_t \) = either dividend yield or default premium, and
- \( TRPM_t \) = term premium for the 1-month horizon.

Chow, Lee and Solt showed in their conclusion that changes in real exchange rates are important in explaining the temporal variation in expected returns on bonds and stocks, and that all assets are exposed to exchange-rate risk. They also showed that the effects of real exchange-rate changes on expected returns are different for bonds, which have fixed income streams, from those for stocks, which have variable cash-flow streams. They added that exchange exposure for stocks reflects both an interest-rate and a cash-flow effect. The cash-flow effect, transaction and economic exposure, are short- and long-run in nature. Using a sample of comp stat industries, Chow, Lee and Solt found that the effect of unanticipated changes in the real exchange rate on earnings is negative over short horizons but positive over long
horizons. Hence, the interest-rate and cash flow effects are offsetting over short horizons but complementary over long horizons.

Bailey and Chung (1995) explored the impact of exposure to exchange rate fluctuation and political risk on stock prices of individual companies on the Mexican stock exchange. They adopted a multifactor model with exchange-rate and political risk factors, and measured the extent to which exposure to these factors could explain cross-sections of return on individual securities and an industry-wide portfolio. They found no evidence of unconditional equity market premiums of the currency and of political risk reflected in the proxy variables they selected.

Choi, Hiraki and Takezouia (1998) investigated whether the exchange-rate risk is priced in the Japanese stock market within a conditional or unconditional multifactor asset-pricing model. They employed the stochastic discount factor pricing Kernel approach in estimating their conditional model. On the other hand, their unconditional model was developed within the traditional framework by explicitly specifying and estimating the parameters in the return-generating process. They used stock return data from an industry portfolio from January 1974 to December 1995. C, H and T found that when using the unconditional model, the exchange risk was priced in the pre-plaza as well as the post-plaza period when the bilateral yen/U.S dollar exchange rate measure was used. The result for the conditional model showed that the exchange risk was priced in the Japanese market regardless of whether the bilateral yen/U.S dollar rate of the multilateral trade-weighted exchange rate was used.
3.6 CONCLUSION

In this chapter, we last provided the theoretical and empirical literature on the determinants of asset pricing. Section 3.2 presented two main theoretical models of asset pricing, namely the CAPM and APT and discussed the implications of these models for the determinants of asset pricing. There we mentioned that the risk premium on a particular asset is determined by systematic risk factors. While the systematic risk is represented by the market portfolio, which is assumed to involve all risky assets in the economy, the APT models the macroeconomic risk factors explicitly. We have also mentioned that the riskiness of a company measured by both models would be equal if we have a theoretically specified market portfolio and true underlying macroeconomic risk factors. However, the predictions of both models need to be tested to see which model fits the data better.

The review of the empirical literature in Section 3.5 shows that the results from the CAPM regressions might be misleading because they are closely related to the choice of market index as a proxy for market portfolio. The problems with the CAPM that stem from the use of a proxy are compounded for those sectors, which are always under-represented in the market index, such as the oil sector. In this sense, the APT model can be thought of as an alternative to the CAPM model and the usefulness of these models in asset pricing can be determined by hypothesising the CAPM against the APT. In this context, it is expected that the APT provides better understanding of asset-pricing because it takes risk factors, like oil prices, into account explicitly and its validity can be checked by employing both models and comparing them. The last part of the empirical literature section also provides a
detailed discussion about the selection of systematic risk factors based on economic theory. Specifically, inflation, interest rates, money supply, exchange rates, and oil prices are extensively used as macroeconomic risk factors in the empirical literature.

Taken together, the discussion on the theoretical and empirical literature shows that the expected return on a particular stock is determined by systematic risk factors, and the extent to which these factors affects stock returns, and whether they have an impact over and above the market returns is an empirical issue. Following the reasons given above, in our empirical analysis, we will employ both CAPM and APT models to find out the determinants of return, in particular the role of oil prices in the Saudi stock market.
CHAPTER FOUR
METHODOLOGY AND THE DATA ANALYSIS

4.1 INTRODUCTION

In this chapter we introduce the models and data employed in the applied chapters and provide a preliminary statistical analysis of it. In this respect, we discuss the different methods followed in constructing unexpected change in macroeconomic variables and define the selected variables employed in the empirical analysis of the study.

Since we use time-series data in our applied work, it is important to establish time-series properties of the data. In particular, it is important to establish the level of integration of the series before carrying out a regression analysis because non-stationary regressors invalidate most of the standard empirical results. For this reason, we investigated the stationary properties of the relevant data set, employing the **Augmented Dickey-Fuller (ADF)** test.

Also, we provide descriptive statistics of the data, which include mean, standard deviation, skewness, and kurtosis of the return of the Saudi stock market general index and of other companies of value to study. This analysis is carried out to
get familiar with the behavioural and general characteristics of return over the sample period. We will also estimate correlation coefficients to observe how the variables relate with each other. Information about the strength of correlations among the variables is important because employing highly correlated explanatory variables in regression analysis may lead to multicollinearity problem and invalidates regression results.

In what follows, Section 4.2 provides information on the sources and definitions of the relevant data employed in the empirical work. Section 4.3 presents the models applied in the empirical chapters. Section 4.4 discusses the time series properties of the relevant data. In there, the unit root test results obtained from estimating ADF regressions will be provided. Section 4.5 presents descriptive statistics of the relevant data. This involves maximum, minimum, mean, standard deviation and skewness of the data and correlation between the relevant variables.
4.2 DATA SOURCES AND DEFINITIONS

This section aims to introduce the sources and definition of data employed in the applied work. The data employed in this thesis are monthly observation for the period 1991 (May) to 2000 (April). The data is collected mainly from the Saudi Arabian Monetary Agency's quarterly and monthly reports, their share control department database, the Saudi Shares Registration Company and OPEC publications. Using the data obtained from these sources, we constructed the variables subject to empirical analysis. Among these variables, the construction of unexpected or surprise variables seemed to be the most difficult and controversial. In what follows, we first present different methods used in the literature to calculate the unexpected variables and discuss their individual deficiencies. Then, we provide the definition of variables that will be employed in our empirical work.

4.2.1 Calculation of the Unexpected Change

Modelling expectations is a controversial issue in economics. A number of different methods for this exist in the literature. The main hypothesis about expectation formation involves static expectations, adaptive expectations, extrapolative expectations, regressive expectations, rational expectations and the perfect foresight hypothesis (Pilbeam, 1992:168-172). We now provide brief information on each of these hypotheses.

Static expectations: According to this hypothesis, the expected future value of a particular variable is equal to its current value. That is, when economic agents form
their expectations about the future, they think that current values will not change and therefore the expected value is equal to current value. Following this method of calculating expected value, we can compute unexpected values of variables by simply taking the first difference of these variables. Although it may seem that is a very crude way to calculate unexpected values, some researchers believe that static expectations can be safely used to calculate unexpected values because “some factors are considered to have so much noise in their time-series data that the change in the data is itself adequate as a measure of unexpected change”.

The Adaptive Expectations Hypothesis says that the expected value of a variable for time \( t+1 \) is equal to a weighted average of the value of that variable at time \( t \) and the expected value of this variable at time \( t \). In other words, the current expectations are obtained by modifying previous expectations in light of the current experience (Kmenta, 1986:528-529). The adaptive expectations model can be formulated as follows:

\[
X^*_{t+1} = (1-\lambda)X_t + \lambda X^*_t \quad 0<\lambda<1
\]

Extrapolative expectations occur when the expected value of a variable for time \( t+1 \) is equal to the value of that variable at time \( t \) plus some multiple (\( \theta \)) of the change in this variable during the previous period. Extrapolative expectations can be represented in this mathematical notation:

\[
X^*_{t+1} = X_t + \theta(X_t-X_{t-1}) \quad \theta > 0
\]

This formation of expectations implies that whatever happened in the previous year is expected to happen in the following year.
The Rational Expectations Hypothesis can be represented as follows: \( X_{t+1}^* = X_{t+1} + u_{t+1} \). As the formula shows, the expected value of the variable \( X \) for the time \( t+1 \) will be equal to the actual value of variable \( X \) because the average of random error is zero. According to the Rational Expectations Hypothesis, because economic agents have full information and know the correct model of the economy, they do not make systematic mistakes and therefore, on average, the expected value of a variable is the value that materialises. In practice, to find out the expected value of a particular variable using the Rational Expectations Hypothesis, we first need to estimate a full macroeconomic model and then, using the coefficients obtained from this model, we look to find the expected values. The unexpected values of a variable are then equal to actual values minus expected values.

Expectation formation due to perfect foresight assumes that the expected value of a variable for the time \( t+1 \) is equal to the actual value of that variable at time \( t+1 \). That is, \( X_{t+1}^* = X_{t+1} \). This implies that economic agents have a complete knowledge of the macroeconomic model of the economy so that they do not make any errors concerning the future values of variables. This means that we should use actual values of variables as their expected values in practice.

Hitherto, we have presented different methods to calculate expected and unexpected values of variables. While the static, adaptive and extrapolative expectation formation mechanisms assume that the value of a variable for time \( t+1 \) can be predicted entirely from its current and past values, rational expectations and perfect foresight models allow economic agents to use a wider set of economic
information when they form their expectations. Both groups of methods have their weaknesses and strengths. In practice, different methods have been applied. In our analysis, we will take deviation from the mean in the same manner used by Bernedt. This is a more practical way to calculate unexpected rather than rational expectations and perfect foresight methods. It is also more intuitive than the static, adaptive and extrapolative expectations method. It also satisfies the APT model assumption that the expected value of surprise variables is equal to zero because we defined surprise variables as deviations from their means. In the following section, the variables subject to empirical analysis will be defined and discussed.
4.2.2 Data Definition

The study uses monthly data for the sample period from May 1991 (m5) to April 2000 (m4). The data series are transformed into the rate of change by taking the log difference in each of the series in the form ln(\(x_t/x_{t-1}\)) (i.e. the log-first difference of the variable of interest). In order to calculate the sample mean of each variable. The "surprise" variable or unexpected change for the relevant variables is then calculated by subtracting the rate of change of each variable in the sample from its mean. The definition and measurement of macroeconomic factors used in this study are presented below.

Unexpected change in real oil prices (urop)

Oil prices have a big impact on the real economic activities of Saudi economy. It is widely believed that there is a positive relationship between oil prices and the Saudi stock market. The increase of oil prices means more revenue and an increase in government expenditure. In this study, we used the unexpected change of real oil prices at time t. We first divided the oil prices at time t by the consumer price index at time t to get real oil prices and then calculated the percentage change of real prices by taking its log difference. Finally, we calculated the unexpected change by subtracting each observation from the mean.
*Unexpected change in real interest rates (urir)*

The relationship between interest rate and stock returns should be expected to be negative according to the present value concept and the substitution effect. In almost all of the previous studies, a significant negative relationship between the observed stock market return and the interest rate has been found. We employed unexpected change in real interest rates and hypothesize a negative relationship between Saudi stock return and interest rates. The real interest rate at time $t$ is obtained by subtracting the 3-month interest rate in the Saudi Riyal at time $t$ from the inflation rate at time $t$. Unexpected change in the real interest rate is calculated by taking the rate of change in the real interest rate, calculating its mean and then subtracting each observation from the mean.

*Unexpected change in inflation (uinfft)*

Economic theory suggests a positive relationship between stock returns and inflation. Surprisingly, empirical studies find a negative relation in general. Several theories have been forwarded to explain this anomalous relationship, but it does not change the fact that the relationship between inflation and stock return appears to be negative. The change in the consumer price index (CPI) is considered as the measure of inflation. In our study we employ unexpected inflation, calculated by taking the percentage change in inflation at time $t$ and then calculating its mean and then subtracting each observation from the mean.

*Unexpected change in exchange rate (uex)*
The sign of a relationship between the exchange rate and stock returns depends on the nature of the firms and whether they are exporting or importing. So it is difficult to determine this relation in a priori. In our case, Saudi Arabia depends, to very large extent, on exporting oil while at the same time importing most of its needs from abroad. The Saudi riyal is fixed to the dollar to avoid fluctuations of exchange rate when the government is preparing its public budget. In this thesis, we calculate the unexpected exchange rate between the Saudi riyal and the pound sterling by taking log difference of the exchange rates and then subtracting each observation from its mean.

**Unexpected change in money supply (um1)**

Narrowly defined money supply M1 consists of the currency in circulation, sight deposit with the banks and the deposit central bank. Another type of money supply is M2 which consists of notes and coins plus demand and the time deposit. The broad measure of money supply consists of M1 + M2 and foreign currency deposit. In this study, the percentage change in the money supply is calculated by taking the difference in the logarithm. The unexpected change of money supply is calculated by subtracting each observation from the sample mean. The relationship between money supply and stock return is expected to be positive.

**Table 4.1: Data Definition.**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Variable</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNINF</td>
<td>Unexpected inflation</td>
<td>$= \Delta \text{inf}, - \Delta \text{inf}$</td>
</tr>
<tr>
<td>Symbol</td>
<td>Description</td>
<td>Formula</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>URIR</td>
<td>Unexpected real interest rate</td>
<td>$\Delta RIR_t - \bar{\Delta RIR}$</td>
</tr>
<tr>
<td>UROP</td>
<td>Unexpected real oil prices</td>
<td>$\Delta ROP_t - \bar{\Delta ROP}$</td>
</tr>
<tr>
<td>UM1</td>
<td>Unexpected money supply</td>
<td>$\Delta UM1_t - \bar{\Delta M1}$</td>
</tr>
<tr>
<td>UEX</td>
<td>Unexpected exchange rate</td>
<td>$\Delta EX_t - \bar{\Delta EX}$</td>
</tr>
<tr>
<td>RM</td>
<td>Return on market portfolio</td>
<td>$\ln(\frac{GSI_t}{GSI_{t-1}})$</td>
</tr>
</tbody>
</table>
4.3 EMPIRICAL MODELS

We have stated earlier that the ultimate goal of this thesis is to find out the determinant of stock return in the Saudi stock market taking into consideration the nature of the Saudi economy as an oil-based economy and the role of oil revenues in shaping the Saudi stock market.

The nature of the market as a closed one and the special characteristics of the Saudi stock market as an emerging market are all factors which may be considered as guidance for the type of models used. In the following we will briefly discuss the models used in this thesis.

4.3.1 The Capital Asset Pricing Model (CAPM)

In Chapter Three we stated that the Capital Asset Pricing model is one of the most widely applied models for measuring the extent of risk associated with assets and hence to explain the determinants of return. The CAPM assumes that the market portfolio contains all the information about the macroeconomic factors. These factors are the only source of risk that faces the investor because unsystematic risk can be avoided through diversification.

In the case of Saudi Arabia, oil prices are considered to be one of the most important factors that influence the economy. Oil revenues constitute about 30% of GDP. However, oil is controlled by the government which receives oil income and spends it on various economic activities based on the budget structure. The Saudi oil
company ARAMCO is not listed in the Saudi stock market. The impact of fluctuating revenues resulting from changing oil prices on Saudi stock returns is an essential phenomenon. Since the oil revenue is spent by the government on various economic activities, this expenditure is reflected on the market index through the various companies listed on the market. It is logical that the impact of oil is captured by the market index and that any change in oil prices will affect market returns. In this case, CAPM would be a proper model to apply since the market portfolio represents adequately all related macroeconomic information. The coefficient beta would be the proper measurement of market risk. However, if this is not the case, then oil and other economic forces would have an independent effect over and above the market portfolio. A presentation of the CAPM model will follow.

The CAPM model assesses the relationship between asset-risk and return by regressing risk-free asset-return and risk free market return. The regression coefficient beta which will be generated from the model is the measure of the asset risk. The model is written as follows:

\[ r_i - r_{ft} = \alpha_i + \beta_i(r_m - r_{ft}) + \varepsilon_i \]  

(4.1)

where,

- \( r_i \) = monthly return on the asset for firm \( i \) at time \( t \). \( i = 0, 1, 2, \ldots, 45 \) and \( t = 1, 2, 3, \ldots, 108 \),
- \( r_{ft} \) = monthly returns to a risk free asset at time \( t \),
- \( \alpha_i \) = constant which shows the return on asset \( i \) when the market risk premium is zero,
\[ r_{mi} \] = monthly return on the Saudi stock market index at time \( t \),

\[ \beta_i \] = asset \( i \) and the return on risk free market index, and

\[ \varepsilon_{it} \] = the error return.

The form of the model shown in equation (4.1) is derived by assuming that returns are normally distributed and that capital markets are efficient. Then, the testable implications of the CAPM model can be summarised as follows: (1) The Beta, \( \beta_i \), should be the only factor that explains the rate of return on a risky asset; (2) in the presence of unlimited borrowing and lending at a risk-free rate, the intercept term, \( \alpha_i \), should not be significantly different from zero (otherwise, this contradicts the prediction of the CAPM that the market only compensates for systematic risk because unsystematic risk can be diversified); (3) The relationship should be linear in beta; (4) Because the market portfolio is riskier, on average, it should have a higher rate of return than the risk-free rate.

Based on the above model, the stocks (or assets) that have higher \( \beta \) are expected to give higher returns or higher losses, because they are riskier than lower \( \beta \) stocks. However, because of their higher risks they are expected to give higher returns in the long-run. Furthermore, non-zero \( \alpha_j \) terms signal the presence of CAPM disequilibrium and, therefore, we interpret the term \( \alpha_j \) as over-priced when \( \alpha_j < 0 \) and under-priced when \( \alpha_j > 0 \). This is in line with the prediction of the CAPM.
4.3.2 The Arbitrage Pricing Theory (APT) Including Market Premium

One of the major differences between APT and CAPM is that the APT allows more than one generating factor, not just “the market”. So, the argument is whether the Saudi stock market return is generated simply by the market portfolio or whether there are other factors that have an effect over and above the market index. In fact, the characteristics of the Saudi stock market and the economic environment within which the market works lead us to question the applicability of CAPM in the Saudi stock market to see whether or not there are economic factors that are not captured by the general market index if the CAPM is applicable. These characteristics can be summarised as follows:

i. It has been clarified in Chapter Two that the Saudi economy is an oil-based economy and that the oil revenues amount to constitute 30% of Saudi GDP. One could argue that the capability of the market index to capture the effect of unexpected change on oil prices in all sectors and company returns, bearing in mind that some sectors in the economy such as agriculture and electricity which is listed in the market, depends on government subsidies where stable oil revenues are the determinant of these payments.

ii. Interest is prohibited according to Islamic law. So, this factor is not assumed to be influential in the return generating process. But, in certain sectors like banks, the existence of an interest rate is vital since most of the public in Saudi Arabia put their money in banks without taking interest. An increase in interest rates would mean more profit for these banks as they deploy these free funds in the international market. So, whether or not the market index captures
the impact of interest rate especially in the banking sector, it needs to be examined.

iii. The exchange rate between the Saudi riyal and U.S. dollar, we repeat, is fixed. The fluctuation of the U.S. dollar should not have an independent impact since most of Saudi trade is with the United States. However, some companies like SABIC whose market is in the Far East and Europe, and banks who invest their money in the international market, may be influenced by a fluctuating exchange rate between the Saudi riyal and other currencies like the pound sterling. This impact in generating returns for these companies may not be captured entirely by the market index.

iv. Finally, the concentration problem that exists in some companies where the decision-making process is carried out by a few people on the board of directors may explain an increase the share of unsystematic risk in the return but also reveal other systematic risk factors that are not captured by the market index.

Based on the above we will employ the APT model which has a more general application than the CAPM. The model will be applied in the same manner used by Ernest R. Berndt (p. 52) and we will follow the methodology of Chen, Roll and Ross (1986).

In this model, systematic risks need not be represented by a single common factor but instead returns can be calculated by a linear k-factor model. Therefore, our model will also include excess return on the market as one of the factors in addition to economy wide “surprises” such as unexpected change in real oil prices, unexpected change in
the real interest rate, the percentage change in the narrowly defined money supply, unexpected change in the exchange rate, and unexpected change in inflation. This will allow us to compare our results with the CAPM results presented in the previous chapter. More precisely, we will assume that all of these surprise variables have no impact on the excess returns of selected assets, as an excess return on the market should capture all changes. The Likelihood Ratio Test will be used to test the validity of the effects of these factors. The rejection of the null hypothesis that the surprise variables have no effect on excess asset returns will be taken as evidence that macroeconomic variables introduce an extra risk over and above the market risk. The model, which is subject to empirical analysis, therefore, can be written as follows:

\[ r_{u} - r_{ft} = \alpha_i + \beta_{0i}(r_{mt} - r_{ft}) + \beta_{1u}urir + \beta_{2u}urop + \beta_{3u}uex + \beta_{4u}uinf + \beta_{5u}dlm + \varepsilon_u \]  

(4.2)

where,

\( r_{u} \) = monthly return on the asset, obtained by subtracting the logarithm of the asset price index for firm \( i \) at time \( t \) from the logarithm of the asset price index for firm \( i \) at time \( t - 1 \). \( i=1,2,\ldots,51 \) and \( t=1,2,3,\ldots,108 \),

\( r_{ft} \) = monthly returns to a risk-free asset at time \( t \), calculated as the 3-month interest rate of the Saudi riyal,

\( \alpha_i \) = the constant term, which shows the return on asset \( i \) when the market risk premium is zero,

\( r_{mt} \) = monthly return on the Saudi stock market obtained by taking the log difference of the Saudi stock market index,

\( urir_{t} \) = unexpected change in the real interest rate,
\( urop_t \) = unexpected change in real oil prices at time \( t \).

\( uex_t \) = unexpected exchange rate between the Saudi riyal and the pound sterling.

\( uinf_t \) = unexpected inflation, and

\( uM1_t \) = unexpected change in the narrow measure of money supply M1.

In our empirical analysis, we estimate equation (4.2) for each company in addition to the six market sector indexes. The contribution of each risk factor to the risk-free asset returns will be assessed through regression coefficients, which will be generated from the model. Then we will employ the Likelihood Ratio Test to verify the impact of unexpected change of five macroeconomic variables on excess returns. This involves the following null and alternative hypotheses:

\[
H_0 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 = 0
\]

\[
H_1 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \neq 0
\]

Failure to reject the null hypothesis would mean that the market index is capturing all changes in macroeconomic variables. This could also mean that the CAPM is enough to explain the excess return of various companies and market sector indexes. In addition, we try to explain if the impact on the sector index differs from the impact of individual companies. The test of the sectors presents the result for each sector in return.
4.3.3 The Arbitrage Pricing Theory (APT) Including Market Timing Risk

As an alternative to the previous APT model, where market risk is included as one of the factors that generate the asset return, market timing risk is the factor that can replaces the market risk factor in this model. The Market timing risk can be defined as the part of the market index total return that is not explained by the macroeconomic variables included in the regression equation and an intercept term.

This factor has been explained by Bruneister, Roll and Ross (2003). The market timing factor is based on the idea that if the risk exposures to all of the macroeconomic variables included in the regression equation were exactly zero, then the market timing risk would be proportional to the market index total return. According to Bruneister, Roll and Ross, under these extremely unlikely conditions, a stock exposure to market timing risk would be equal to its CAPM beta.

In our case, the market timing risk will be produced from regressing the five macroeconomic factors: unexpected change in real oil prices, unexpected change in the exchange rate, unexpected change in money supply, unexpected change in the real interest rate, and unexpected change inflation on the market index. The residual from the equation is considered as the part that cannot be explained by the five macroeconomic factors and the intercept $\alpha$.

$$Rm_t - Rf_t = \alpha + \beta_1 uRiR_t + \beta_2 uROP_t + \beta_3 uex_t + \beta_4 uinf_t + uml_t + e_t$$  \hspace{1cm} (4.3)

So our model, which is subject to empirical analysis, can be written as follows:
\[ r_i - r_f = \alpha_i + \beta_i urir + \beta_2 urop_i + \beta_3 uex_i + \beta_4 u \inf_i + \beta_5 dlm_i + \beta_6 mtr_i + \varepsilon_i \] (4.4)

where,

- \( r_i \) = monthly return on the asset, obtained by subtracting the logarithm of the asset price index for firm \( i \) at time \( t \) from the logarithm of the asset price index for firm \( i \) at time \( t - 1 \). \( i = 1, 2, ..., 51 \) and \( t = 1, 2, 3, ..., 108 \),
- \( r_f \) = monthly returns to a risk free asset at time \( t \), calculated as the 3-month interest rate of the Saudi riyal,
- \( \alpha_i \) = the constant term, which shows the return on asset \( i \) when the market risk premium is zero,
- \( r_m \) = monthly return on the Saudi stock market, obtained by taking the log difference of the Saudi stock market index,
- \( urir \) = unexpected change in the real interest rate,
- \( urop_i \) = unexpected change in real oil prices at time \( t \),
- \( uex_i \) = unexpected exchange rate between the Saudi riyal and the pound sterling,
- \( u \inf_i \) = unexpected inflation,
- \( uM1_i \) = unexpected change in the narrow measure of money supply \( M1 \), and
- \( mtr_i \) = the market timing risk calculated by regressing five macroeconomic variables on the excess return of the Saudi market index.

In empirical analysis, we estimate the above equation for each company in addition to market sector index. This involves the following null and alternative hypothesis.

\[ H_0 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 = 0 \]
\[ H_1 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 \neq 0 \]
Failure to reject the null hypothesis would mean that none of the above factors have any effect in generating the asset excess return.
4.4 TIME-SERIES PROPERTIES OF THE DATA

4.4.1 The Augmented Dickey Fuller Unit Root Test

Stationarity is the key point of the concept of co-integration and stationary series should at least have constant unconditional mean and variance over time while the value of covariance between periods depends only on the gap between periods. In fact, the mean, variance, autocovariances are independent of time (i.e. remain constant over time). The degree of integration of a series is also closely related with a stationary and a non-stationary series which can be transformed into a stationary one by successive differencing of the series. It is obvious that the properties of a stationary series and a non-stationary series are quite different (Hall and Hendry, 1988: 48). It is still possible to run regressions, even if the time-series do not satisfy the stationary assumption. However these regressions could simply be spurious (or meaningless). This leads us to the concept of “spurious regression (correlation)”. The existence of a high degree of correlation between, say, two variables does not imply that there exists a causal relationship between them. So the regression which includes spuriously correlated variables is referred to as a spurious regression. In this respect, spurious regression results usually arise when the regression variables are non-stationary. Since many macroeconomic time-series are typically non-stationary, this is of particular interest to applied economists (see Hendry, 1980). Another drawback for time sense data is to have trends and these series have to be de-trended before any sensible regression analysis is performed. It is already known that this is done by successive differencing.
4.4.2 The ADF Test: Augmented Dickey Fuller

In order to investigate the stationary properties of the relevant data set, ADF tests can be employed. The purpose of ‘augmenting’ the Dickey-Fuller (DF) regression is to achieve white noise errors. The ADF test of unit roots (Dickey and Fuller 1979; 1981) is widely regarded as one of the most efficient tests for integration levels. In practice, it is regarded as the favourite test among the practitioners. It is known as the augmented Dickey-Fuller test (ADF) and is also widely regarded as being the most efficient test for integration levels. This can be formulated as follows:

\[ \Delta X_t = \gamma X_{t-1} + \sum_{j=1}^{p} \beta_j \Delta X_{t-j} + \alpha + \delta t + \varepsilon_t \quad (4.5) \]

where \( \Delta X_t \) is the first difference of the series, \( p \) is the number of lags and \( t \) is time. A practical rule for establishing the number of lags for \( \Delta X_{t-1} \) (or the value of \( P \)) is that it should be relatively small in order to save degrees of freedom, but large enough to secure the lack of autocorrelation of the error term.

The ADF statistics results for these variables are shown in Table 4.2. The visual inspection of the variables in hand confirms the view that the variables in question – urop, um1, uex, unif, urir, mtr, rm, rbi, rii, rc, rsi, rei, and rai – are all stationary in level. In other words, the ADF test results for unit roots confirm that all variables are integrated at an order of zero.
Table 4.2: Investigation of the ADF Test Results

| Variables | Test Statistics & Critical Values |  |  |  |  |  |  |  |
|-----------|----------------------------------|---|---|---|---|---|---|
|           | With Trend                       | Without Trend                  |  |  |  |  |  |  |
|           | Intercept | No. of Logs | C.V. (5%) | Intercept | No. of Logs | C.V. (5%) |
| urop      | -6.24     | 0           | -2.89     | -6.29     | 0           | -3.46     |
| um1       | -9.08     | 0           | -2.89     | -9.10     | 0           | -3.46     |
| uex       | -7.33     | 1           | -2.89     | -7.34     | 1           | -3.46     |
| uinf      | -9.80     | 0           | -2.89     | -10.21    | 0           | -3.46     |
| urir      | -1.77     | 1           | -2.89     | -3.17     | 1           | -3.46     |
| mtr       | 8.44      | 0           | -2.89     | -8.48     | 0           | -3.46     |
| rm        | -8.40     | 0           | -2.89     | -8.40     | 0           | -3.46     |
| rbi       | -4.50     | 2           | -2.89     | -4.51     | 2           | -3.46     |
| rii       | -9.38     | 0           | -2.89     | -9.32     | 2           | -3.46     |
| rei       | -7.63     | 0           | -2.89     | -7.61     | 0           | -3.46     |
| rsi       | -9.19     | 0           | -2.89     | -9.18     | 0           | -3.46     |
| rei       | -8.75     | 0           | -2.89     | -8.71     | 0           | -3.46     |
| rai       | -8.60     | 0           | -2.89     | -8.58     | 0           | -3.46     |

Notes: The corresponding critical values for 108 numbers of observations at the 5% significance levels are obtained from Mackinnon (1991) and reported by MFIT 4.0. It is worth noting that the intercept and trend terms are in the ADF equations. The numbers in the parenthesis indicate that zero, one, four, seven and eight augmentations are necessary to secure a lack of auto-correlation of the error terms with regard to the variables. We chose the Akaike Information Criterion to determine ADF values.
4.5 DESCRIPTIVE STATISTICS OF THE DATA

The Saudi economy went through several crisis between 1990 and 2000, such as the Gulf War and the drop of oil prices. Also, the stock market has witnessed the introduction of the Electronic Share Information System (ESIS). In the following we will look at the behaviour of the market index, sector indexes, and various stocks listed in the market over the sample period.

The overall activities of the market and the descriptive statistics of the main indexes and companies’ indices are presented in Table 4.3. The statistics of the relevant data involved the maximum and minimum prices, mean, std. deviation, skewness, kurtosis of the data, and coefficient of variation. The results are reported for the stock returns of different sectors and stocks listed in the Saudi stock market over the sample period. The average return on the market portfolio over the sample period was 0.00% while the maximum return was 0.14% when the minimum was -0.12%. This may give an indication about the state of the economy and the events which followed the Gulf War. The market increased at first when the level of expenditure increased in order to boost the war effort, and then to promote political stability in the region. But after that the economy had to pay the costs of war and market prices fell.

In the sectoral level, when comparing the performance of various sectors, we found that the banking sector gave the highest average return of 1% while the average return of the agriculture sector was -1%. Among forty five companies listed in the market, twenty five had a positive average return over the sample period, while
another twenty had a negative return. The highest average return company was the Saudi Hollandi Bank with 1.9% while the lowest was Hayel Agriculture with -1.7%.

Stock return volatility as measured by standard deviation was 0.05 for the market portfolio. The Live Stock Company and Tihamah Advertising showed the highest standard deviation of 0.13. The coefficients of skewness indicate that the indexes in the different industries in Saudi stock market were not equal to zero, as expected for a normal distribution.
Correlation Matrices

We would like to note that one of the assumptions of the classical linear regression model is that there is no perfect multicollinearity. In other words, no exact linear relationship exists among explanatory variables included in a multiple regression. Firstly, one of the classic symptoms of multicollinearity is high R2 but few significant t-ratios. The second classic symptom of multicollinearity is high pair wise correlations among explanatory variables. Explaining this is our main aim in this part. Of course, there are other indicators that provide us with clues about the existence of multicollinearity such as examination of partial correlations, computing subsidiaries, or auxiliary regressions and using the variance inflation factor (VIF). In fact, multicollinearity is the existence of a strong relationship among some or all explanatory variables of a regression. It does not affect the best-unbiased estimator of the OLS but since coefficients have large standard errors, they tend to be insignificant, thus, making precise estimation difficult (Gujarati, 1999:319).

The best way to solve the multicollinearity is to understand the cause of it and remove it. As we have seen, multicollinearity occurs because two or more variables are related and they measure essentially the same thing. If one of the variables doesn’t seem logically essential to the model, removing it may reduce or eliminate multicollinearity. We can also reduce the impact of multicollinearity by increasing the sample size. However, multicollinearity some time may occur because the model chosen for empirical analysis is not carefully thought out, maybe some important variables are omitted or perhaps the functional form of the model is incorrectly chosen. In this case perhaps rethinking the model might be the only solution.
The tables from 4.4 to 4.10 in Appendix 4.1 strate the matrix of correlation coefficients of the variables used in our regression equation. As the tables show, the pair wise correlations between the variables have no serious problem of multicollinearity. It is worth emphasizing that we expect to have low correlation between the explanatory variables and high correlation between the dependent and the explanatory variables. Table 4.4 present the correlation matrix for the market index and other exogenous variables on the regression equation. All figures show that none of the variables are correlated which means that no problem of multicollinearity exist between variables. Table 4.5 provides the variables (i.e. Rbi is dependent) with respect to the regression equation. It can be seen that return in the banking sector index and unexpected change in the exchange rate correlate more compared with other variables. In the same table, other pair-wise correlations are reasonably fine and do not provide any probability in terms of multicollinearity. Table 4.6 represent the variables (i.e. Rii is dependent) with respect to regression equation. It can be seen at return in the industrial sector index and other variables are not correlated with give evidence that multicollinearity exist between variables the rest of tables also represent the correlation between the cement, service electricity and agriculture sector indexes. As the table shows the pair wise correlation between the explanatory variables are very low. These result where as expected; we can conclude, there for that correlation among the variables under study do not suffer from multicollinearity problems since our estimated result are acceptable from a statistical point of view.
In this chapter we have introduced the models and data applied in the empirical analysis. We used monthly data over the period 1991 (May) – 2000 (April). The data was mainly collected from Saudi monetary agency database.

We also presented the various methods used in constructing the unexpected change in the variables and defined each variable. In addition, we investigated the stationary levels of the relevant data set and we found all variable are stationary. In other words, the ADF test results for unit roots confirm that all variables are integrated at an order of zero, I (0) in levels.

We then checked whether there exists a multicollinearity problem in our data set. It should be noted that the correlations among the variables under this study do not matter in respect of a multicollinearity problem except to a minor extent. In parallel, we examined descriptive statistics of the relevant variable used in the study. This situation confirms that the returns/indices for the sectors and firms are normally distributed.
Table 4.3: Descriptive Statistics of the Relevant Data

<table>
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<tr>
<th>Variable</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Kurtosis-3</th>
<th>Code of variation</th>
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<td>Kurtosis</td>
<td>Code of variation</td>
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**Notes:** Skewness measures the asymmetry of the distribution of the series of the data around their mean. The skewness of a normal distribution is zero. Kurtosis measures the peak or flatness of the distribution of the data series. The kurtosis of the normal distribution is 3. If the kurtosis exceeds 3, the distribution is leptokurtic and if less than 3 platykurtic relative to normal distribution.
Table 4.4: Estimated Correlation Matrix for the General Share Index

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<th></th>
<th>RM</th>
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<th>UROP</th>
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Table 4.5: Estimated Correlation Matrix for the Banking Sector Index

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Table 4.6: Estimated Correlation Matrix for the Industry General Index

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<td>0.030332</td>
<td>-0.11685</td>
<td>-0.020564</td>
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<tr>
<td>UM1</td>
<td>-0.057412</td>
<td>0.031557</td>
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<td>-0.069105</td>
<td>0.012397</td>
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Table 4.7: Estimated Correlation Matrix for the Cement Sector Index

<table>
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<th></th>
<th>RCI</th>
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<th>UROP</th>
<th>UEX</th>
<th>UINF</th>
<th>UM1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCI</td>
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<tr>
<td>URIR</td>
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<td>UROP</td>
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<tr>
<td>UEX</td>
<td>0.028165</td>
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Table 4.8: Estimated Correlation Matrix for the Service Sector Index

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<th>$UROP$</th>
<th>$UEX$</th>
<th>$UINF$</th>
<th>$UM1$</th>
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Table 4.9: Estimated Correlation Matrix for the Electricity Sector Index

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<th>UROP</th>
<th>UEX</th>
<th>UINF</th>
<th>UM1</th>
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</thead>
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<td>0.030332</td>
<td>-0.11685</td>
<td>-0.020564</td>
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<tr>
<td>UM1</td>
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<td>0.031557</td>
<td>0.053844</td>
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<td>0.012397</td>
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Table 4.10: Estimated Correlation Matrix for the Agriculture Sector Index

<table>
<thead>
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<th>URIR</th>
<th>UROP</th>
<th>UEX</th>
<th>UINF</th>
<th>UM1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAI</td>
<td>1</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>URIR</td>
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</tr>
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<td>UEX</td>
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</tr>
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<td>-0.11685</td>
<td>-0.020564</td>
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<tr>
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<td>0.053844</td>
<td>-0.069105</td>
<td>0.012397</td>
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</table>
Figure 4.1: Unexpected Real Oil Prices (urop) 1991-2000.

Figure 4.2: Unexpected Money Supply (um1) 1991-2000.
Figure 4.3: Unexpected Exchange Rate (uex) 1991-2000.

Figure 4.4: Unexpected Inflation (uin) 1991-2000.
Figure 4.5: Unexpected Real Interest Rate (urir) 1991-2000.

Figure 4.6: Market Timing Risk (mtr) 1991-2000.
Figure 4.7: Return at Market Portfolio (rm) 1991-2000.
5.1 INTRODUCTION

In Chapter 3 we concluded that the Capital Asset Pricing Model (CAPM) is the most widely employed model in investigation of the performance of stock markets in the empirical literature. According to CAPM, systematic risk is the only factor, which determines return on assets, because investors can easily eliminate unsystematic risk through diversification by investing on the market portfolio. We therefore begin our empirical analysis by investigating the risk-return relationship in the Saudi stock market over the period May 1991 to April 2000 to determine the usefulness of CAPM in analysing the Saudi Stock market and the extent to which there are significant differences across industries and companies in terms of risk-return relationship. In total, we will estimate the CAPM model for 45 companies related to six different sectors, listed in the Saudi stock market in 1991.

Considering the fact that making a profit has always been a driving force behind investors, it might be argued that the Saudi stock market behaves no differently from any other stock market in the world and that macroeconomic variables exercise no power over and above the market effect on returns. Therefore, we can safely employ CAPM in the investigation of the performance of the Saudi
stock market. However, as mentioned in Chapter 2, in which we provided a review of the Saudi economy and the Saudi stock market, the expenses of Gulf war of 1990 and declining oil prices following the war severely affected the performance of the Saudi economy and the Saudi stock market causing budget deficits and public debt to increase. Nevertheless, this does not harm our argument about the applicability of the CAPM for the Saudi stock market. This is because, all this information including the change in oil prices and the changes in macro-economic policies is accommodated into the market portfolio and the risk adverse investors have taken this new information into account when they made their investment decisions. Of course, this rather restrictive assumption will be relaxed and tested in the next chapter and its implications will be discussed, especially in terms of the impact of oil prices on the performance of stock returns.

The remaining part of this chapter is organised as follows. Section 5.2 provides the empirical CAPM model, which will be employed in our empirical analysis, and discusses possible implications of this model. Section 5.3 introduces a monthly time-series data covering the Saudi Stock market at aggregate and disaggregate levels. Some of the facts about the data are described in this section as well. In Section 5.4, we will present the empirical results obtained from estimating the CAPM for 45 firms and to six different sectors then discuss possible implications of these results for the performance of the Saudi Stock market. Section 5.5 is devoted to a discussion of the results and the conclusion.
5.2 THE EMPIRICAL MODEL

The model, which is subject to empirical analysis in this chapter, is the CAPM model. We have already provide detailed discussion of the model in chapter 4 and stated that the risk-free returns on assets will be regressed on the risk-free market return in the following manner:

\[ r_i - r_f = \alpha_i + \beta_i (r_{mf} - r_f) + \epsilon_i \]  

(5.1)

where,

- \( r_i \) = monthly return on the asset for firm \( i \) at time \( t \), \( i=0,1,2,\ldots,45 \) and \( t=1,2,3,\ldots,108 \),
- \( r_f \) = monthly returns to a risk-free asset at time \( t \),
- \( \alpha_i \) = constant which shows the return on asset \( i \) when the market-risk premium is zero,
- \( r_{mf} \) = monthly return on the Saudi stock market index at time \( t \),
- \( \beta_i \) = slope of regression line that shows the relationship between risk-free return on asset \( i \) and the return on the risk-free market index, and
- \( \epsilon_i \) = the error return.

Based on the above model, the stocks (or assets) that have higher \( \beta \) are expected to give higher returns or higher losses, because they are riskier than lower \( \beta \) stocks. However, because of their higher risks they are expected to give higher returns in the long-run. Furthermore, non-zero \( \alpha_j \) terms signal the presence of CAPM
disequilibrium and therefore, we interpret the term \( \alpha_j \) as overpriced when \( \alpha_j < 0 \) and under priced when \( \alpha_j > 0 \) in comparison with the prediction of the CAPM.
5.3 PRELIMINARY OVERVIEW OF THE DATA

Before undertaking the econometric analysis, this section introduces the data employed in the applied work. The data is a monthly time-series covering the period from the beginning of May 1991 until April 2000. We have already provided a detailed discussion of the stock market data subject to empirical analysis and presented the descriptive statistics and preliminary statistical analysis of the data in Chapter 4. In this section, therefore, we simply comment on the main features of the data. The study covers the monthly return for 45 companies related to six different sectors listed in the Saudi stock market in addition to the return of the sectoral market index return. Eight out of forty-five companies relate to the banking sector, ten to the industrial, seven of them are cement sectors, ten of them are services, three of them electricity and the remaining seven companies are agriculture sectors. In the selection of the firms for each sector, the availability and the reliability of the data played the most important role.

Classification of the firms according to sectors is as follows:

Sectored Market Indexes
1. Bank Sector Index
2. Industrial Sector Index
3. Cement Sector Index
4. Services Sector Index
5. Electricity Sector Index
6. Agriculture Sector Index
**Bank Sector**

1. Riyadh Bank
2. Bank Al-Jazira
3. Saudi Investment Bank (SAIB)
4. Saudi Holland Bank (SHB)
5. Al Bank Al Saudi Al Fransi (BSF)
6. Saudi British Bank
7. Arab National Bank (ANB)
8. Al Rajhi Banking & Investment Co.

**Industrial Sector**

1. Saudi Basic Industries Co. (SABIC)
2. Saudi Arabia Fertiliser Co. (SAFCO)
3. Saudi Arabian Refiners Co. (SARCO)
5. Saudi Veg. Oil & Ghee Co. (SAVOLA)
6. National Industrial
8. National Gas Industrialisation Co. (GASCO)
10. Food Products Co.

**Cement Sector**

1. Arabian Cement Co. Ltd.
2. Yamamah Saudi Cement Co. Ltd
4. The Qassim Cement co.
5. Southern Providence Cement.
6. Yanbu Cement Co.
7. Eastern Providence Cement Co.
Services Sector

2. Saudi Real Estate Co.
4. Saudi Public Transport Co. (SAPTCO)
5. Saudi Automotive Services Co. (SASCO)
6. Al Mawashi & Al Mukairish Co.
7. Tihama Advertising & Public Relations Co.
9. Taibah Investment & Real Estate Co.
10. Mecca Investment & Real Estate Co.

Electricity Sector

2. Saudi Consol. Elec. Co. – SCECO-Western

Agriculture Sector

1. National Agriculture Development Co. (NADEC)
2. Gassim Agriculture Co. (GACO)
3. Hail Agriculture Development Co. (HADCO)
4. Tabouk Agriculture Development Co. (TADCO)
5. Saudi Fisheries Co.
6. Eastern Agriculture Development Co. (SHADCO)
7. Al Jouf Agriculture Development Co.

The variables that will be used in the empirical analysis are introduced in the previous section and the detailed account of construction and sources of the variables of interest is given in Chapter 4.
5.4 EMPIRICAL RESULTS

The primary concern of this section is to present results obtained by estimating the CAPM equation described previously for 45 companies listed on the Saudi stock market and six different sectors using monthly time-series data for the period 1991m5-2000m4. Classification of the firms according to sectors is described in the previous section. Before presenting the results from the CAPM model, a number of issues should be briefly noted. As mentioned in Chapter 4, models containing non-stationary variables will often lead to a problem of spurious regression. To avoid problems of spurious regression we carried out unit root tests and found that all variables of interest are stationary. Unit-root test results and detailed discussions on this subject are already provided in Chapter 4. Therefore, in our empirical analysis, an Ordinary Least Squares (OLS) estimation procedure is employed. Our estimation results are presented in the tables 5.1-5.7. These results involved the estimates of the CAPM equation, in where the t-statistic on the estimate of $\beta_i$ corresponds to testing the null hypothesis of $\beta_i = 0$ against the alternative hypothesis of $\beta_i \neq 0$, and related diagnostic statistics. In addition, because it is of interest, in the spirit of CAPM, to see whether the return to particular company’s share is the same as that of the market as a whole, we tested the null hypothesis of $\beta_i = 1$ against alternative hypothesis of $\beta \neq 1$. The results obtained from these tests are also provided in the tables 5.1-5.7. It is worth mentioning that the estimates of the CAPM equation and the corresponding statistical measures presented in the result tables have particularly interesting interpretations within CAPM. The following sub-sections present an analysis of sector results and a discussion of risk-return relationship.
5.4.1 Banking Sector

The estimated equation for each bank is presented in Table 5.1. The summary statistics and diagnostic statistics associated with each equation are also given in this Table. These include the $R^2$, the estimated standard error of the equation $\sigma$ and statistics for test of residual serial correlation $\chi^2_{sc}$, functional form $\chi^2_{ff}$, normality $\chi^2_n$ and heteroscedasticity $\chi^2_{hi}$.

The results presented in the table provide some interesting insights into the risk-return relationship in the banking sector. First, the companies' risks in the banking sector are higher or equal to the average risk of the entire market. An inspection of the results shows that the market risks or systematic risks, measured by $\beta$, are statistically and significantly different from zero and positive for all banks. To see the magnitude of bank $i$'s systematic risk level relative to the average systematic risk level on the stock market, we applied the Wald test. The null hypotheses that $\beta$ are equal to one were rejected for three banks, namely Riyadh, Al-Jazira and Arab National bank. For these banks, $\beta$'s are more than one, which implies that these banks have higher risk over the market or aggressive stocks. In other words, non-diversifiable risk for these banks is higher than the market. Null hypothesis could not be rejected for the other five banks in the banking sector suggesting that these banks have the same systematic risk as the market index.

The second conclusion to be derived from the results is finding that a substantial amount of firm $i$'s risk-premium is explained by changes in the market risk-premium
and firms' systematic risk-premiums vary significantly among banks. This can be observed from the extent of $R^2$, which measures the market portion of total risk and presented in Table 5.1. While the market risk is more than 55%, for Riyadh and Arab National bank, it is around 50% for four banks out of eight and it is only around 30% for Saudi investment banks and Saudi Hollandi. As we know from the finance literature, riskiness of a company in systematic risk terms is closely related to the extent to which the company's revenues are determined by macro-economic factors which is outside the control of its management and cannot be diversified away. In this sense, it can be argued that all banks in Saudi market are sensitive to changes in macro-economic factors, except Saudi investment bank and Saudi Hollandi bank.

The observed sensitivity of banks to changes in macro-economic factors is closely related to the nature of the banking sector and the characteristics of the economy within they are operating. The banking sector is naturally exposed to systematic risk because its revenue depends on the general level of activity in the economy. When the economy is booming, the demand for loans will increase leading to high revenues for banks. However, if the economy is depressed, banks suffer from bad debts. That is why the banking sector is exposed to changes in macroeconomic factors. In the case of Saudi Arabia, there are three more reasons explaining why the banking sector is sensitive to systematic risk factors. First, as mentioned before, almost all Saudi government debts are local debts, which are borrowed from local banks. This means that a high level of bank loans in Saudi Arabia is used to finance government debts and a fall in oil revenues puts more pressure on the banking sector. Second, the banks are not fully protected when they offer loans to the public because the Sharia law prohibits interest so there is no law enforcement to require the loans to be repaid.
Third, in such a legislative environment, banks generally choose to invest abroad exposing themselves to exchange rate risks.

Although the reasons given above hold for the banking sector in general, in the case of the Saudi Hollandi Bank and the Saudi Investment Bank, the limited number of shareholders and its associated problem of concentration may explain why these two banks have relatively low market risk and a limited exposure to macroeconomic factors. Systematic risk would be lower for these banks because the limited number of shareholders will influence the style of management and decision making process and hence increase the unsystematic riskiness of these banks for the end of the year 2000, there were 2164 shareholders in the Saudi Investment Bank and 938 in the Saudi Hollandi Bank. The number of shares traded in the Saudi Holandi Bank, for example, in the first six months in the year 2000 was about one hundred thousand compared with 15 million shares in the Riyadh Bank and 7 million in the Al-Rajhi Investment Company. This may indicate that shares in the company are not traded because most of them are held by the foreign partners and a big business Saudi family who do not trade their own shares in the market.

Thirdly, the results presented in Table 5.1 imply that bank-specific risk (or unsystematic risk) involves a significant amount of the total risk and the standard deviation of unsystematic risk varies among banks. While the proportion of unsystematic risk in total risk is measured by $1 - R^2$, the standard error of regression gives the standard deviation of unsystematic risk. An examination of the results table shows that while the company-specific risk, which is about 65%, is relatively high for the Saudi Hollandi Bank and the Saudi Investment Bank, it is the lowest for the
Riyadh Bank and the Arab National Bank at around 40%. For the other banks, unsystematic risk is around 50%. In terms of dispersion of unsystematic risk, while the Al-Rajhi and Riyadh Banks have a standard deviation of 5%, the Al-Jazira and Saudi Investment banks have the highest standard deviation with 8%. The proportion of this high standard deviation of the regression indicates that the substantial amount of changes in bank risk-premiums cannot be explained by changes in the market premium. The control of the banks by a limited number of shareholders and the domination of a small number of Saudi business families on the banks boards’ of directors may explain such high company-specific risks. Another reason that would be given in this case is that the Saudi banks are working in an oligopoly market where only a limited number of banks are allowed to work in Saudi Arabia. This is the direct result of the Saudization of the banks in 1985, which allowed no other banks to work in the country. Both reasons may lead to poor management quality through lack of competition and little accountability.

Fourthly, the intercept term is not statistically significant in seven of the eight banks. This is not a surprise because, in a situation where the market risk premium is zero, the banks should not have any risk premium either. In other words, the market only compensates for systematic risk because unsystematic risk can be diversified and therefore the market does not provide a return for unsystematic risk. This implies that the intercept term should be zero. However, the results for the Riyadh Bank show the presence of a positive and statistically significant constant term. This would imply that investors in the Riyadh Bank expect a positive rate of price appreciation even if the market return is zero. In other words, this indicates that the Riyadh Bank’s share price is under its market value (or under-priced) and maybe expected to rise.
However, this conclusion should be taken with caution due to the change in its capital structure in 1992. However, since the intercept is not significant for these seven banks, these shows that the CAPM is a valid model to be applied in this sector for one of the conditions of applicability of this model is that \(a\) must equal zero.

Finally, the estimated results for risk presented in Table 5.1 have acceptable diagnostics in general and explains a substantial amount of the variations in return. The test results indicate no sign of auto-correlation for all banks. Only the Riyadh Bank has hetero cadasticity problem. The test of functional form is only rejected for the Riyadh and Saudi French banks. However, normality is comprehensively rejected in six of the eight banks. The rejection of normality assumptions does not invalidate our results in statistical terms because the Ordinary Least Squares (OLS) procedure does not make any assumptions about the distribution of error terms. Although OLS estimators provide biased estimates when normality assumption does not hold, they are still consistent in large samples. In our analysis, we rely on this property of OLS estimators. However, the rejection of the functional form and the normality assumptions may raise a more important question about the validity of the CAPM model in analysing risk return relationships in the Saudi stock market implying the presence of missing or omitted variables in the regression. In our next empirical chapter, we will discuss these issues in detail.
### Table 5.1: The Riskiness of Saudi Banks listed in Saudi Stock Market, 1991-2000

<table>
<thead>
<tr>
<th>Company</th>
<th>$a_i$</th>
<th>$b_i$</th>
<th>$R^2$</th>
<th>$\sigma$</th>
<th>$\chi^2_{sc}$</th>
<th>$\chi^2_{B}$</th>
<th>$\chi^2_{H}$</th>
<th>WALD</th>
</tr>
</thead>
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<tr>
<td>Riyadh Bank</td>
<td>.0220</td>
<td>1.417</td>
<td>.6303</td>
<td>.0542</td>
<td>(14.60)</td>
<td>(10.13)*</td>
<td>(47.18)*</td>
<td>(15.64)*</td>
</tr>
<tr>
<td></td>
<td>(3.019)*</td>
<td>(13.44)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank Al-Jazira</td>
<td>.0082</td>
<td>1.401</td>
<td>.4309</td>
<td>.0805</td>
<td>(12.43)</td>
<td>(2.472)</td>
<td>(27.29)*</td>
<td>(.9367)</td>
</tr>
<tr>
<td></td>
<td>(7.625)</td>
<td>(8.96)*</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Saudi Investment Bank (SAIB)</td>
<td>.0168</td>
<td>1.148</td>
<td>.3081</td>
<td>.0860</td>
<td>(18.53)</td>
<td>(.3144)</td>
<td>(14.82)*</td>
<td>(.9015)</td>
</tr>
<tr>
<td></td>
<td>(1.450)</td>
<td>(6.870)*</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Saudi Holland Bank (SHB)</td>
<td>.0151</td>
<td>1.004</td>
<td>.3614</td>
<td>.0667</td>
<td>(8.034)</td>
<td>(.3712)</td>
<td>(1.621)</td>
<td>(.0236)</td>
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<td></td>
<td>(1.686)</td>
<td>(7.745)*</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Al Bank Al Saud Al Fransi (BSF)</td>
<td>.0072</td>
<td>1.104</td>
<td>.4890</td>
<td>.0564</td>
<td>(14.15)</td>
<td>(4.252)**</td>
<td>(.3359)</td>
<td>(.2134)</td>
</tr>
<tr>
<td></td>
<td>(9.495)</td>
<td>(10.07)*</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi British Bank</td>
<td>.0135</td>
<td>1.224</td>
<td>.4764</td>
<td>.0642</td>
<td>(19.22)</td>
<td>(.0826)</td>
<td>(79.20)*</td>
<td>(.0042)</td>
</tr>
<tr>
<td></td>
<td>(1.565)</td>
<td>(9.820)*</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Arab National Bank (ANB)</td>
<td>.0118</td>
<td>1.324</td>
<td>.5555</td>
<td>.0592</td>
<td>(9.580)</td>
<td>(.0945)</td>
<td>(6.067)**</td>
<td>(1.078)</td>
</tr>
<tr>
<td></td>
<td>(1.485)</td>
<td>(11.51)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al Rajhi Banking &amp; Investment Co.</td>
<td>-.0033</td>
<td>.9475</td>
<td>.4674</td>
<td>.0506</td>
<td>(23.96)**</td>
<td>(2.785)</td>
<td>(46.74)*</td>
<td>(.1344)</td>
</tr>
<tr>
<td></td>
<td>(-.4811)</td>
<td>(9.65)*</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Notes:** Coefficients refer to the following regression: $r_u - r_f = \alpha_i + \beta_i(r_{mt} - r_f) + \epsilon_u$. Values in parentheses are t-statistics. One (*) star shows that they are significant at the 1% level and two (**) indicate that they are significant at 5% level. Variable definitions are provided in the text and their sources given in Chapter 5. $R^2$ is the square of the multiple correlation coefficient, $\sigma$ is the equation standard error. $\chi^2_{sc}$ (1) is the first order LM test of serial correlation, $\chi^2_{B}$ (1) is the test of functional form, $\chi^2_N$ (2) is the test of Normality of errors and $\chi^2_H$ is the test of heteroscedasticity. WALD is the Wald test statistics carried out on the null hypothesis of $\beta_i = 1$. One (*) star shows that they are significant at the 1% level and two (**) indicate that they are significant at 5% level.
5.4.2 Industrial Sector

The estimated CAPM equations for the 10 firms in the industrial sector are presented in table 5.2. A review of the results presented in table 5.2 shows the following important points about the industrial sector. First, the degree of responsiveness of the expected return on shares relative to movements in the expected return on the market, which is measured by \( \beta_i \), differs significantly among companies in the industrial sector; \( \beta_i \) values range from -0.08 for National Gypsum company to 1.22 for SABIC. While the null hypotheses of \( \beta_i = 0 \) are rejected for eight out of the ten companies indicating that the market risk measured by \( \beta_i \) is statistically significantly different from zero, the null hypothesis cannot be rejected for the National Gypsum Company and the Saudi Arabian Refiners Company. For these companies, which have a statistically significant \( \beta_i \)'s, we also tested whether the movement of asset prices of these companies is the same as that of the market (i.e. the null of \( \beta_i = 1 \) against an alternative hypothesis of \( \beta_i \neq 1 \)) using the Wald test. The test results show that a null hypothesis of \( \beta_i \) is equal to one could not be rejected for SABIC, SAFCO, National Industrial, Saudi Pharmaceutical and Food Product Co. This implies that these companies behave exactly the same as the market as a whole. The Saudi Arabian Refiners Co., Saudi Ceramic, SAVOLA, and National Gas, however, seem to have a lower risk than the market index. Therefore, these stocks can be labelled as defensive stocks. National Gypsum with negative \( \beta \) shows that this company is extra defensive stock but the \( \beta \) for this company is statistically insignificant, which makes any statistical inference unimportant. However, we are still concerned with the negative
sign \( \beta \) found for this company because it may give some indication about the behaviour of its traders. Although National Gypsum Co. has a long history compared to other Saudi companies, the volume of shares traded in that company remained very limited even in 2000. For example, in the first 6 months of year 2000, the volume of shares traded was only 42000 shares compared with 21 million shares traded for SABIC and 21 million traded for national industry company. This shows that the shares of this company are held by a limited number of shareholders, who are very reluctant to trade in the stock market. However, in theory "asset with negative beta coefficients offers a form of insurance against variability in the rate of return on the market portfolio. Hence, the expected rate of return on such an asset will be lower than the risk-free rate, again a somewhat paradoxical result. The paradox is resolved by noting that 'risk' in CAPM is associated with a positive correlation with the market rate of return, so that the absence of risk corresponds not with the certainty associated with \( r_0 \) but, instead, to a negative correlation with the return on the market portfolio" (Bailey, 2003:116)

The estimation results presented in table 5.2 have generally acceptable diagnostics and explain some of the variation in returns in the industrial sector. The test results indicated no sign of auto-correlation on eight out of ten companies and no heteroscedasticity for nine companies. The test of functional form was only rejected for the Food Product Company at 5% level of significance. Normality tests were rejected in all companies of the industrial sector. As we discussed in the previous subsection, the observed diagnostics not invalidate the results from CAPM equations in the industrial sector. However, the rejection of normality in error terms implies that
there is a room for doubt if there is an omitted factor, which affects the company returns in this sector in addition to market returns.

Secondly, the intercept term was statistically significantly different from zero for six companies out of ten. We know from discussions on the CAPM model in Chapter 3, the market does not provide any return for diversifiable risks and, therefore, we expect the intercept term to be zero. It is also argued that a statistically significant intercept term can be used as evidence against the validity of the CAPM model. However, an examination of the results in table 5.2 shows that the constant term was negative and statistically significant for six out of ten companies, which may indicate that CAPM may not be applicable for most of the companies in this sector. Furthermore, the negative sign observed for most of the shares in this sector implies that investors in these firms expect price depreciation even if the market return is zero. Therefore, we can conclude that these shares are over-priced and their prices are expected to decrease.

The third conclusion we may drive from table 5.2 is related to the market portion of the total risk measured by $R^2$. While $R^2$ is less than 10% for four out of ten companies in the industrial sector, it varies between 20% and 35% for another five companies and is 50% for the basic Saudi industry, SABIC. This implies that market variation explains only a small portion of a stock’s large variability for most of the companies in the industrial sector. In other words, market risk (or systematic risk) constitutes only a small portion of the total risk in this sector. Combining this information with high $\beta$ values for these companies (such as SABIC, National
Industry), we can argue that the reaction of these stocks to market variations is very sharp but the market explains only a small portion of their variability.

Fourthly, the estimation results show that company-specific risk seems to be very high for companies listed in the industrial sector. As mentioned before, a particular company’s risk premium is composed of systematic risk and unsystematic (or specific risk). While we measure the extent of systematic risk by $R^2$, $1 - R^2$ gives us the degree of specific risk. An examination of table 5.2 implies that almost all the risk in the industrial sector can be attributed to company-specific risk, which ranges from 99% for National Gypsum to 55% for SABIC. Considering the fact that unsystematic risk is related to the quality of management and the level of advertising, it is unconceivable that almost all companies in the industrial sector perform very poorly on these issues although this may be partly explained by the closed and small scale nature of the Saudi economy and the nature of the market as a closed market. This might be more to do with missing some important factors from the equation than from any observations of high unsystematic risk. Another important point about unsystematic risk is that its standard deviation differs significantly from 10% to 5% among companies. Having SABIC excluded, this also implies that a substantial amount of change in industrial sector firms’ risk premium could not be explained by changes in the market premium.

To summarise the findings on the industrial sector, a number of points needs to be noted. For companies in the industrial sector, while systematic risk explains a small portion of total risk, very high unsystematic risk can be observed. If this is true, then we can conclude that the impact of macro-economic factors (which are the main
determinants of systematic risk) can be ignored in explaining the company-risk premium. However, we also noted above that normality is comprehensively rejected; the constant term is negative and statistically significant for most of the companies. Maybe, all this information suggests that some important factors are missing from the CAPM equation.

Information related to unexpected change in real oil prices, unexpected change in money supply, unexpected change in exchange rate and unexpected change in inflation will be added to return of market index to see their influences over and above the market in the next empirical chapter. These variables are not the only information that might be omitted from equation as some other factors such as industrial production, GDP, which will not be included due to the lack of monthly data related to these variables. It is worth mentioning that as the Saudi stock market is closed, and the volume of loans and facilities given to the public is an important variable since most traders use loans to buy shares which leads to increase the prices and consequently the ability of traders to take more loans which fuel the increase the prices, and when prices decrease the heavy selling to pay back these loans push the prices down.


<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_i$</th>
<th>$R^2$</th>
<th>$f$</th>
<th>$\chi^2_{sc}$</th>
<th>$\chi^2_{ff}$</th>
<th>$\chi^2_n$</th>
<th>$\chi^2_I$</th>
<th>WALD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Basic Industries Co.</td>
<td>.0127</td>
<td>1.226</td>
<td>.4456</td>
<td>.0684</td>
<td>(9.873)</td>
<td>(.2350)</td>
<td>(.0841)</td>
<td>(2.897)</td>
<td></td>
</tr>
<tr>
<td>(SABIC)</td>
<td>(1.386)</td>
<td>(9.230)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia Fertiliser Co.</td>
<td>.0036</td>
<td>1.060</td>
<td>.3250</td>
<td>.0763</td>
<td>(19.15)</td>
<td>(.0547)</td>
<td>(1.535)</td>
<td>(.1617)</td>
<td></td>
</tr>
<tr>
<td>(SAFCO)</td>
<td>(.3493)</td>
<td>(7.144)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Arabian Refiners</td>
<td>-.0451</td>
<td>.1728</td>
<td>.0285</td>
<td>.0504</td>
<td>(4.632)</td>
<td>(.3257)</td>
<td>(8.899)</td>
<td>(71.27)*</td>
<td></td>
</tr>
</tbody>
</table>

179
<table>
<thead>
<tr>
<th>Company</th>
<th>Returns</th>
<th>Standard Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co. (SARCO)</td>
<td>(-6.657)*</td>
<td>(1.763)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Ceramic Co.</td>
<td>-0.0364</td>
<td>(3.877)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Veg. Oil &amp; Ghee Co. (SAVOLA)</td>
<td>-0.0246</td>
<td>(5.281)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Industrial</td>
<td>0.0039</td>
<td>(6.411)*</td>
<td>-0.0971</td>
<td>0.0752</td>
<td>(1.667)</td>
</tr>
<tr>
<td>Saudi Pharmaceutical Indus. &amp; Med. Appliances Corp.</td>
<td>-0.0155</td>
<td>(3.377)*</td>
<td>-0.0246</td>
<td>(5.281)*</td>
<td></td>
</tr>
<tr>
<td>National Gas Industrialisation Co. (GASCO)</td>
<td>-0.0321</td>
<td>(2.694)*</td>
<td>-0.0246</td>
<td>(5.281)*</td>
<td></td>
</tr>
<tr>
<td>National Gypsum Co.</td>
<td>-0.0460</td>
<td>(-5.540)</td>
<td>-0.0460</td>
<td>0.0824</td>
<td>(1.831)</td>
</tr>
<tr>
<td>Food Products Co</td>
<td>-0.0184</td>
<td>(6.709)*</td>
<td>-0.0460</td>
<td>0.0824</td>
<td>(1.831)</td>
</tr>
</tbody>
</table>

Notes: see notes from Table 5.1.
5.4.3 Cement Sector

The results from the estimated CAPM equations for the seven companies in the cement sector are presented in Table 5.3. The table provides the following remarks concerning the risk-return relationship in the cement sector. First, the $\beta$ values of companies in the sector, which measures the amount of company $i$'s systematic risk relative to that of the market, are statistically and significantly different from zero. The magnitude of $\beta$'s ranges from 0.41 for the Qassim Cement Company to 0.93 for the Yanbu Cement company. We also tested the null hypothesis that $\pi_i$ is equal to one to see whether these figures are statistically different from one or less than one using the Wald test. The results from the Wald test suggest that while the Arabian Cement, Saudi Cement and Yanbu Cement companies have the same risk as the market index, the remaining four companies have the $\beta_i$ coefficient less than one implying that these companies have a lesser risk than the market index. It seems that the stocks in the cement sector are defensive stocks because the degree to which the cement companies mostly are exposed to systematic risk is relatively less than elsewhere in the market. In contrast to the banking sector, the cement sector companies react relatively slowly to market movements and the effect of macro-economic factors on their performance is lower than the market.

Secondly, the intercept term, although it has a negative sign for all companies, is statistically insignificant as predicted by the CAPM. A detailed explanation was given in previous discussions on this point. The null hypothesis that the intercept term is equal to zero was rejected only in the case of Qassim Cement at 1% level.
Furthermore, the negative sign on the constant term for this company indicates that
this company is overpriced and its price can be expected to fall.

Thirdly, the market portion of total risk, measured by $R^2$ varies among companies in
this sector. While the share of systematic risk in total risk for Qassim Cement is 10%,
it is around 25% for the Yamama Saudi Cement and South Province Cement
companies. For the remaining four companies, the portion of systematic risk is about
30%. It seems that the companies in the cement sector have both low $\beta$ values and
low $R^2$ implying that the reaction of cement sector stocks to market variations is very
slow and market variation explains only a small portion of the stocks variability.

Fourthly, company risk in the cement sector seems to be very high ranging from 90%
for the Qassim Cement Company to 70% for the Yanbu Cement Company. These are
very high figures indicating that a substantial amount of change in cement sector
companies’ risk-premium cannot be explained by changes in the market premium. In
other words, almost all risk in this sector is company-specific and very little to do
with macroeconomic factors. However, we normally expect the performance of the
cement sector to be closely related to the general performance of the economy and
affected by changes in macroeconomic factors.

Fifthly, a comprehensive rejection of normality in error terms across cement sector
firms may be interpreted as an effect of the missing factor in regression equation even
though it does not cause a problem in terms of estimation results. This point was also
explained before. An examination of the other diagnostics tests for companies in the
cement sector show no sign of auto-correlation, heteroscedasticity or functional from
problems. However, when the rejection of normality and an unusually high company-specific risk obtained from CAPM equations are taken together, they imply the existence of an omitted variable in our regressions.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_i$</th>
<th>$R^2$</th>
<th>$\phi$</th>
<th>$\chi^2_{sc}$</th>
<th>$\chi^2_{ff}$</th>
<th>$\chi^2_n$</th>
<th>$\chi^2_{ll}$</th>
<th>WALD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabian Cement Co. Ltd.</td>
<td>-.0142</td>
<td>.8925</td>
<td>.3023</td>
<td>.0678</td>
<td>(12.42)</td>
<td>(1.347)</td>
<td>(35.06)*</td>
<td>(3.155)</td>
<td>(.6663)</td>
</tr>
<tr>
<td></td>
<td>(-1.554)</td>
<td>(6.777)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yamamah Saudi Cement Co. Ltd</td>
<td>-.0132</td>
<td>.7440</td>
<td>.2440</td>
<td>.0655</td>
<td>(12.87)</td>
<td>(1.415)</td>
<td>(15.29)*</td>
<td>(.0128)</td>
<td>(4.050)**</td>
</tr>
<tr>
<td></td>
<td>(-1.505)</td>
<td>(5.848)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Cement Co.</td>
<td>-.0123</td>
<td>.7737</td>
<td>.2858</td>
<td>.0611</td>
<td>(9.386)</td>
<td>(6.100)</td>
<td>(14.03)*</td>
<td>(.5031)</td>
<td>(3.631)</td>
</tr>
<tr>
<td></td>
<td>(-1.495)</td>
<td>(6.513)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qassim Cement Co.</td>
<td>-.0276</td>
<td>.4106</td>
<td>.1038</td>
<td>.0603</td>
<td>(12.36)</td>
<td>(11.150)</td>
<td>(21.75)*</td>
<td>(.0858)</td>
<td>(25.31)*</td>
</tr>
<tr>
<td></td>
<td>(-3.410)*</td>
<td>(3.504)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern Providence Cement.</td>
<td>-.0136</td>
<td>.7337</td>
<td>.2832</td>
<td>.0584</td>
<td>(6.691)</td>
<td>(2.013)</td>
<td>(2.967)</td>
<td>(.8493)</td>
<td>(5.519)**</td>
</tr>
<tr>
<td></td>
<td>(-1.740)</td>
<td>(6.471)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yanbu Cement Co.</td>
<td>-.0097</td>
<td>.9341</td>
<td>.2256</td>
<td>.0865</td>
<td>(14.51)</td>
<td>(2.733)</td>
<td>(210.7)*</td>
<td>(.5754)</td>
<td>(.1535)</td>
</tr>
<tr>
<td></td>
<td>(-.8302)</td>
<td>(5.556)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Providence Cement Co.</td>
<td>-.0087</td>
<td>.7783</td>
<td>.3051</td>
<td>.0587</td>
<td>(10.14)</td>
<td>(1.583)</td>
<td>(16.09)*</td>
<td>(.0189)</td>
<td>(3.776)**</td>
</tr>
<tr>
<td></td>
<td>(-1.107)</td>
<td>(6.822)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: see notes from Table 5.1.
5.4.4 Services Sector

The results obtained from employing the CAPM equation in the services sector companies and the corresponding summary statistics are presented in Table 5.4. Taken together, the results table provides the following insights into the risk-return relationship for the services sector. First, the companies’ risks in the service sector vary significantly among companies ranging from 0.42 to 1.47. The null hypothesis that $\beta_i$ is equal to one is rejected in three companies of the services sector at the 1% level and one at a 5% level of significance. The possible explanation for variation in the degree of risk observed depends largely on the nature of investors in these companies. Those with $\beta_i$ equal one are all speculating companies such as National Shipping, Saudi Automotive, Almawashi and Taibah. For example, the number of shares traded in Almawashi for the first six months of year 2000 is more than 23 million comparing with 170 thousand for the hotel companies. Inspection of diagnostic tests for companies in the services sector indicates no sign of autocorrelation, heteroscedasticity or a functional-form problem. Normality is rejected for 8 out of 10 companies.

The second insight to be derived from the results is that almost 70% of the total risk is company-specific risk for seven companies while it is more than 80% for the other three companies. This also means that stock in the services sector do not react to movements in general economic activity. Normally, we expect the services sector to be the most sensitive sector to changes in the macroeconomic factors in the economy. In other words, it is expected to change with the movements of the market and have a higher systematic risk. The reason for this unusual result might be that these
companies with more than 80% specific risk are low-traded companies namely Saudi Real State, Tihama and the Asir Trading Company.

The third insight is that the standard error of the residual is larger as it varies between 4.8% and 12.6% which may lead to the conclusion that substantial amounts of change in companies in the service sector have a risk-premium which could not be explained by the changes in market premium.

The fourth insight is that the stock prices for three companies in services sector seem to be over-priced and expected to fall. An inspection of Table 5.4 shows that the intercept term is negative and statically significant for three companies, namely Saudi Real Estate, Saudi Transportation and the Assir Trading and Tourism companies. Although the intercept term is negative for the other five companies, it is not statistically significant. For the remaining two companies, it is positive but not statistically significant.
### Table 5.4: The Riskiness of Firms in Services Sector listed in Saudi Stock Market, 1991-2000.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_i$</th>
<th>$R^2$</th>
<th>$\delta$</th>
<th>$\chi^2_{sc}$</th>
<th>$\chi^2_{ff}$</th>
<th>$\chi^2_n$</th>
<th>$\chi^2_{H}$</th>
<th>WALD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Hotels &amp; resort Areas. Co.</td>
<td>-.0226</td>
<td>.5963</td>
<td>.2297</td>
<td>.0546</td>
<td>(10.26)</td>
<td>(.6826)</td>
<td>(23.20)*</td>
<td>(1.184)</td>
<td>(14.48)*</td>
</tr>
<tr>
<td>Saudi Real Estate Co.</td>
<td>-.0304</td>
<td>.4526</td>
<td>.1840</td>
<td>.0476</td>
<td>(8.941)</td>
<td>(.3075)</td>
<td>(4.592)</td>
<td>(.3481)</td>
<td>(34.97)*</td>
</tr>
<tr>
<td>Saudi National Shipping Co.</td>
<td>-.0074</td>
<td>1.117</td>
<td>.3448</td>
<td>.0770</td>
<td>(10.58)</td>
<td>(1.566)</td>
<td>(93.31)*</td>
<td>(.6334)</td>
<td>(.6106)</td>
</tr>
<tr>
<td>Saudi Public Transport Co. (SAPTCO)</td>
<td>-.0245</td>
<td>.6318</td>
<td>.3630</td>
<td>.0418</td>
<td>(7.280)</td>
<td>(.0019)</td>
<td>(5.752)</td>
<td>(4.226)**</td>
<td>(20.51)*</td>
</tr>
<tr>
<td>Saudi Automotive Services Co. (SASCO)</td>
<td>-.0141</td>
<td>.9395</td>
<td>.3128</td>
<td>.0696</td>
<td>(9.484)</td>
<td>(0.0058)</td>
<td>(115.3)*</td>
<td>(1.013)</td>
<td>(.1997)</td>
</tr>
<tr>
<td>Al Mawashi &amp; Al Mukairish Co.</td>
<td>.0152</td>
<td>1.472</td>
<td>.3045</td>
<td>.1112</td>
<td>(18.00)</td>
<td>(1.660)</td>
<td>(774.4)*</td>
<td>(.2567)</td>
<td>(4.775)**</td>
</tr>
<tr>
<td>Tihama Advertising &amp; Public Relations Co.</td>
<td>-.0135</td>
<td>.7521</td>
<td>.0788</td>
<td>.1286</td>
<td>(12.87)</td>
<td>(.3216)</td>
<td>(1082)*</td>
<td>(.1612)</td>
<td>(.9841)</td>
</tr>
<tr>
<td>Assir Trading, Tourism &amp; Manufacturing Co.</td>
<td>-.0236</td>
<td>.6358</td>
<td>.1832</td>
<td>.0671</td>
<td>(11.31)</td>
<td>(.9126)</td>
<td>(60.50)*</td>
<td>(.1386)</td>
<td>(7.800)*</td>
</tr>
<tr>
<td>Taibah Investment &amp; Real Estate Co.</td>
<td>.0064</td>
<td>1.215</td>
<td>.3264</td>
<td>.0872</td>
<td>(13.42)</td>
<td>(5.209)**</td>
<td>(257.8)*</td>
<td>(.0754)</td>
<td>(1.602)</td>
</tr>
<tr>
<td>Mecca Investment &amp; Real Estate Co.</td>
<td>-.0051</td>
<td>.9663</td>
<td>.3269</td>
<td>.0693</td>
<td>(9.897)</td>
<td>(2.196)</td>
<td>(17.61)*</td>
<td>(.3674)</td>
<td>(.0625)</td>
</tr>
</tbody>
</table>

**Notes:** see notes from Table 5.1.
5.4.5 Electricity Sector

Before going into a detailed analysis of the electricity sector, it might be helpful to give some idea about the nature of this sector and the way its companies have developed. The three companies listed in the market were created as a result of merging small companies in various cities into one company in each region of Saudi Arabia. The majority of shares in these companies belong to the government. Private investors who have shares in these companies are guaranteed dividends equal to 7% of the company's share value. On these facts it is very difficult to classify these companies as to whether they are in the private or public sector. All of the electricity companies make losses and so they have to be subsidised. They are subsidised by the government since none of their agencies can function without electricity all of which is generated by these three companies.

The electricity sector consists of these three Saudi constituted Electricity Companies: SCECO Central, SCECO Eastern and SCECO Western. When applying the CAPM equation on these companies the results are as follow. First, when testing the null hypothesis of $\beta_i = 0$ we found that $\beta_i$ is positive and statistically significant for all companies in the sector. Their magnitude of $\beta_i$ is around 0.5. A null hypothesis that beta equal to one is rejected for all companies. Since all $\beta_i$ are positive and less than one, we can presume that company stocks in the electricity sector are defensive stocks because they are less risky than the market index.

Secondly, as can be observed from the diagnostic statistics, the estimation results show no sign of auto-correlation or heteroscedasticity or functional form problems.
However, normality is rejected for all companies indicating that the market portion of the total risk is very low. The examination of $R^2$ which measures the market portion of total risk shows that the market risk is approximately 5% for two of the combines but 17% for the third. This implies that market variation explains only a very small portion of these 3 stock's variability. Again this can be attributed to the nature of the electric companies, which depend largely on government subsidies. So, the level of government subsidies might be the factor that explains the variability of their shares rather than the market variation.

Third, the standard error of residual varies from 5.3% and 8%. Fourth, the intercept term has negative and statistically significant coefficients for all three companies. As mentioned before, the CAPM model predicts that the intercept term should be zero because the market does not compensate for diversifiable risk. Having found negative and significant coefficients indicates that the stocks in the electricity sector are over-priced on the one hand, while on the other, there are doubts about the usefulness of the CAPM model in estimating the risk-return relationship.
Table 5.5: The Riskiness of Firms in Electricity Sector listed in Saudi Stock Market, 1991-2000.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_i$</th>
<th>$R^2$</th>
<th>$\delta$</th>
<th>$\chi^2_{sc}$</th>
<th>$\chi^2_{ff}$</th>
<th>$\chi^2_n$</th>
<th>$\chi^2_{WALD}$</th>
<th>WALD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCECO-Central</td>
<td>(-3.698)*</td>
<td>(4.831)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Consol. Elec. Co. -</td>
<td>-.0313</td>
<td>.4346</td>
<td>.1022</td>
<td>.0644</td>
<td>(15.50)</td>
<td>(.4608)</td>
<td>(42.83)*</td>
<td>(.0237)</td>
<td>(20.43)*</td>
</tr>
<tr>
<td>SCECO-Western</td>
<td>(-3.617)*</td>
<td>(3.474)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Consol. Elec. Co. -</td>
<td>-.0239</td>
<td>.5226</td>
<td>.0540</td>
<td>-.0491</td>
<td>(2.761)</td>
<td>(.1266)</td>
<td>(60.63)*</td>
<td>(.2259)</td>
<td>(20.71)*</td>
</tr>
<tr>
<td>SCECO-Eastern</td>
<td>(-3.293)*</td>
<td>(4.980)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: see notes from Table 5.1.
5.4.6 Agriculture Sector

It is widely known that the majority of Saudi Arabia is desert and there is a scarcity in its water resources. In fact, most of the agriculture companies were founded as a result of government subsidies relating to the production of grain. Between the years 1990-2000 as a result of the economic problems which faced the country these subsidies were not paid. This influenced the value of the shares in these enterprises which were the cheapest in the market.

The estimated CAPM equations for these seven companies in the agriculture sector are presented in Table 5.6. An inspection of the table provides the following information about the risk-return relationship in the sector. The $\beta_i$ estimates obtained from the CAPM equation are positively and statistically and significantly different from zero for all the companies. The magnitudes of $\beta_i$'s are between 0.34 and 0.64 indicating that these companies are very slow to react to changes in the market. The Wald test indicates that $\beta_i$'s were positive and less than one for five companies meaning that these stocks are defensive stocks.

An examination of Table 5.6 also shows that the estimation results have generally acceptable diagnostics and explain a substantial amount of variation in returns. In addition, the test results indicate no sign of auto-correlation or heteroscedasticity problems. However, normality is rejected for all companies. The second piece of information we can derive from Table 5.6 is that $R^2$, which measures the market portion of total risk, varies between .29 and .06. The reason for the low $R^2$ might be due to the nature of the agricultural sector, which depends largely on
government subsidies and when these subsidies are paid, the share prices go up regardless of market behaviour. This also indicates that company-specific risk is very high in the agriculture sector. Thirdly, the standard error of the residual varies from 3.6% to 9.6% per month across companies in the agricultural sector.

Finally, Table 5.6 shows that the intercept term is negative and statistically significant for four out of the six companies indicating that these stocks are over-valued and therefore their share value can be expected to decline.

With this finding, the validity of CAPM once again becomes questionable. The rejection of an intercept equal to zero may indicate that some factors are captured by the intercept over and above the market. However, in the next chapter we will introduce some macroeconomic variables besides the market-risk premium to see whether these factors have an effect in generating asset-excess returns.
Table 5.6: Riskiness of Firms in Agriculture Sector listed in Saudi Stock Market, 1991-2000.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_i$</th>
<th>$R^2$</th>
<th>$\sigma$</th>
<th>$\chi^2_{sc}$</th>
<th>$\chi^2_H$</th>
<th>$\chi^2_{n}$</th>
<th>$\chi^2_{H}$</th>
<th>WALD</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Agriculture Development Co. (NADEC)</td>
<td>-.0352</td>
<td>.4774</td>
<td>.3063</td>
<td>.0359</td>
<td>(10.36)</td>
<td>(18.65)*</td>
<td>(3.008)</td>
<td>(56.08)*</td>
<td></td>
</tr>
<tr>
<td>Gassim Agriculture Co. (GACO)</td>
<td>-.0350</td>
<td>.6474</td>
<td>.1795</td>
<td>.0692</td>
<td>(18.87)</td>
<td>(5.136)</td>
<td>(.3217)</td>
<td>(6.883)*</td>
<td></td>
</tr>
<tr>
<td>Hail Agriculture Development Co. (HADCO)</td>
<td>-.0531</td>
<td>.3477</td>
<td>.0701</td>
<td>.0633</td>
<td>(8.714)</td>
<td>(83.74)*</td>
<td>(.1264)</td>
<td>(28.14)*</td>
<td></td>
</tr>
<tr>
<td>Tabouk Agriculture Development Co. (TADCO)</td>
<td>-.0332</td>
<td>.5470</td>
<td>.2105</td>
<td>.0530</td>
<td>(9.446)</td>
<td>(99.35)*</td>
<td>(.7460)</td>
<td>(19.39)*</td>
<td></td>
</tr>
<tr>
<td>Saudi Fisheries Co.</td>
<td>-.0398</td>
<td>.5272</td>
<td>.1404</td>
<td>.0652</td>
<td>(19.04)</td>
<td>(6.730)**</td>
<td>(.1705)</td>
<td>(13.92)*</td>
<td></td>
</tr>
<tr>
<td>Eastern Agriculture Development Co. (SHADCO)</td>
<td>-.0218</td>
<td>.7297</td>
<td>.1381</td>
<td>.0911</td>
<td>(14.13)</td>
<td>(1781)*</td>
<td>(.1065)</td>
<td>(2.332)</td>
<td></td>
</tr>
<tr>
<td>Al Jouf Agriculture Development Co.</td>
<td>-.0236</td>
<td>.5320</td>
<td>.0696</td>
<td>.0972</td>
<td>(18.34)</td>
<td>(3.0110)</td>
<td>(1368)*</td>
<td>(1.084)</td>
<td>(6.142)*</td>
</tr>
</tbody>
</table>

Notes: see notes from Table 5.1.
5.4.7 Sectoral Indexes

The estimated equation for each sectoral index is presented in Table 5.7. The summary statistics and diagnostic statistics associated with each equation are also given in this table. These include $R^2$, the estimated standard error of the equation, $\delta$ and statistics for a test of residual $\chi^2_{sc}$, functional form $\chi^2_{ff}$, normality $\chi^2_n$, and heteroscedasticity $\chi^2_h$.

The table provides some interesting insights in the risk. Return relationship in the various sectoral indexes. First sector indexes risk are varied compared to the average risk of the entire market. Results show that the systematic risk measured to $\gamma \beta$, are significantly different from zero and positive for all sector indexes. To see the magnitude of sector's Systematic risk level relative to the average systematic risk on the stock market, we applied the Wald test. The null hypothesis that $\beta_i$ s are equal to one were tested.

When comparing the systematic risk measured by $\beta_i$ in the sector index and the companies listed in each sector, we find that systematic risk in the sectoral level is equal to an arithmetic mean of all $\beta_i$ s value in the sector. We also find that a substantial amount of sectoral indexes' risk-premium is explained by changes in the market risk-premium and the sectors systematic risk-premium varies significantly among different sectors. This can be observed from the extent of $R^2$, which measures the market portion of total risk and is presented in Table 5.7. While the market risk is more than 86% in the banking sector index, it is around 78% in the industrial index.
Both the cement and agriculture sectors have an $R^2$ around 47%. The amount of risk-premium in the services sector, explained by changes in the market index, is 58%. The explanatory power of the market risk-premium in the electricity sector is very low and $R^2$ is around 23%.

When comparing the amount of risk-premium explained by changes in the market risk in the sector index level and the companies listed in each sector, the amount of risk premium explained in the sector level increase substantially. The reason is that each sector which consists from several companies is considered as a portfolio so the value of $R^2$, as a measure of the market portion of the total risk, increases the benefiting from diversification in the sector index. However, the $R^2$ in the banking sector index was very high proving the earlier point that the banking sector is more sensitive to change in the macro economic variable. The industrial sector amount of risk-premium, explained by changes in the market risk-premium, may increase substantially. This might be attributed to the powerful effect of SABIC in this sector which has a big exposure to macro economic factors.

Thirdly, the results in Table 5.7 imply that the sector’s specific risk or unsystematic risk in value lowers the amount of the total risk and the standard deviation of unsystematic risk. While the proportion of unsystematic risk to total risk is measured by $1 - R^2$, the standard error of regression gives the standard deviation of systematic risk. The table shows that while the electricity sector’s specific risk, which is about 77%, is high the banking and industrial sectors have the lowest specific risk with around 14% for banking and 22% for industry. For other sectors, unsystematic risk is around 42% in the services sector and 54% for agriculture and cement. In terms of
dispersion of unsystematic risk, while the electricity sector has the highest standard deviation of 5%, the banking sector has the lowest standard deviation of 2%. A proportion of the small standard deviation of the regression in the banking that can be noted indicates that a substantial amount of change in the banking sector risk-premium could be explained by the market risk premium. However, other sectors' standard deviation ranges between 3%-4%. The exposure of some sector to changes in macro economic variables and the dependence of some sectors on government subsidies, may explain the variations in the sectors specific-risk.

Fourthly, although the intercept term is not statistically significant in the industrial sectoral index, it is statistically significant and $\alpha \neq 0$ in the other five sectors. This result violates the basic assumption of the CAPM that $\alpha$ should equal zero, and indicates that when the risk-premium of the market is zero, the sector risk-premium may not be zero. The reason for this result in the aggregate level might be because not all information related to macro economic variables may be captured by the market index. Some of it may be captured by the intercept. This is not the case in the disaggregate level.

Finally, the results presented in Table 5.7 seem, in general, to be diagnostically acceptable. They indicate no sign of auto-correlation in any sector except the industrial sector and no heteroscedasticity problem except in the services sector. The test of functional form is only rejected for the industrial sector. However, normality is comprehensively rejected in all sectors. This rejection of a normality assumption and of the functional form in the industrial sector may raise the question of the validity of the CAPM model in the analysis of the risk-return relationship in the Saudi stock
market at the sectoral level. It may imply the presence of missing or omitted variables in the regression.


<table>
<thead>
<tr>
<th>Sector Index</th>
<th>$\alpha$</th>
<th>$\beta_i$</th>
<th>$R^2$</th>
<th>$\delta$</th>
<th>$\chi^2_{ac}$</th>
<th>$\chi^2_{ff}$</th>
<th>$\chi^2_n$</th>
<th>$\chi^2_{H}$</th>
<th>WALD</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_i$</td>
<td>0.011</td>
<td>1.17</td>
<td>0.864</td>
<td>0.0232</td>
<td>1.216</td>
<td>1.524</td>
<td>23.47</td>
<td>0.087</td>
<td>(14.33)*</td>
</tr>
<tr>
<td>$i_i$</td>
<td>0.0032</td>
<td>1.0654</td>
<td>0.784</td>
<td>0.028</td>
<td>2.89</td>
<td>4.25*</td>
<td>67.8*</td>
<td>0.09</td>
<td>1.45</td>
</tr>
<tr>
<td>$c_i$</td>
<td>-0.0119</td>
<td>0.799</td>
<td>0.478</td>
<td>0.0426</td>
<td>8.517*</td>
<td>0.011</td>
<td>24.05*</td>
<td>0.178</td>
<td>(5.87)*</td>
</tr>
<tr>
<td>$s_i$</td>
<td>-0.0116</td>
<td>0.913</td>
<td>0.582</td>
<td>0.039</td>
<td>0.796</td>
<td>0.005</td>
<td>23.6*</td>
<td>4.52*</td>
<td>1.33</td>
</tr>
<tr>
<td>$e_i$</td>
<td>-0.0217</td>
<td>0.573</td>
<td>0.229</td>
<td>0.053</td>
<td>0.047</td>
<td>0.022</td>
<td>528*</td>
<td>0.906</td>
<td>(17.53)*</td>
</tr>
<tr>
<td>$a_i$</td>
<td>-0.032</td>
<td>0.596</td>
<td>0.455</td>
<td>0.033</td>
<td>0.0336</td>
<td>2.77</td>
<td>34.05</td>
<td>0.596</td>
<td>(40.85)*</td>
</tr>
</tbody>
</table>

Notes: see notes from Table 5.1.
5.5 CONCLUSION

In this chapter, we investigated the risk-return relationship in the Saudi stock market at aggregated and disaggregated levels. To this end, we employed the OLS estimation procedure in estimating the CAPM equations for 45 companies in the Saudi stock market using monthly time-series data for the period May 1991 to April 2000. The estimation results reveal a number of important insights into risk-return relationships in the Saudi Stock market.

First, the magnitude of systematic risk measured by betas shows variations within and across industries. While the banking sector has a beta of about 1.20 on average, the average betas for the electricity and agriculture sectors are only around 0.5. The corresponding figure for the services sector is 0.88 and about 0.72 for the cement and industrial firms. These figures imply that shares in the banking sector have higher risk over the market index therefore it can be called aggressive stocks.

The more disaggregated results show that twenty-one companies have the same risk as the market index in which the null hypothesis of \( \beta = 1 \) could not be rejected. The remaining twenty-four companies have betas different from one. Among these companies, only three in the banking sector have \( \beta_i \) higher than one. These banks are the Riyadh, the Al-Jazira and the Arab National Bank. This implies that these stocks are aggressive stock while 21 other companies with \( \beta_i \) less than one can be called defensive stocks.
Secondly, by looking into $R^2$ as a measure of the market portion of the total risk, the results show that while systematic risk accounts for 46% of the total risk in the banking sector, the corresponding figures for the remaining industries are very low ranging between 25% and 11%. These figures also imply that large variations in the company risk premium can be attributed to unsystematic risk since the portion of total risk, which is not explained by the market, is called unsystematic risk. At the company level, the results show that 7 companies have a risk of around 50% of the total risk in company-specific risk. Six of these companies are banks. Another 7 companies have 65 company-specific risks. 14 companies have 75% company-specific risk. These are mostly from the cement sector or long-term investment shares. The rest of companies have 85% company-specific risk. Most of them are electricity and agriculture companies both sectors of which subsidised by the government.

Moreover, the null hypothesis that the constant term is zero is only rejected for 18 companies and could not be rejected for 27 others implying the validity of CAPM in most cases. The constant term was negative in most cases indicating that these companies are over-priced. Those companies in which a hypothesis null is rejected are agricultural and electricity companies, which are not active companies and depend on government subsidies. In this sense, it can be argued that the CAPM was largely acceptable in estimating risk-return relationships in the market. We should also add that the diagnostics related to the CAPM equations are, in general, acceptable.

However, the CAPM states that the systematic risk for an asset is measured by $\beta$ while the unsystematic risk is measured by the error term. This assumes that the intercept $\alpha$ should be equal to zero otherwise the CAPM model will not be applicable since some factors are captured by the intercept. In our case we found that CAPM is
applicable for 26 companies out of 45. For these companies the power of the market portfolio in explaining the proportion of systematic risk measured by $R^2$ was very low in some cases. These results create the need to specify the sources of systematic risk that were not captured by the market portfolio and to examine if there are any other macroeconomic factors that have an effect over and above the market. In the rest of the companies where the CAPM was not applicable, we also need to see what are the determinants of stock-return, taking into consideration what we have mentioned earlier that the Saudi economy is an oil based economy and that the fluctuation of oil prices may not be captured by the market index, especially as one of the major critiques of the CAPM is the validity of markets indexes as a proxy for that markets portfolio which should include all assets in the economy. So, in our next chapter we will include some other economic factors to see their effect over and above the market index. These factors are the unexpected change in real oil prices, unexpected change in money supply, unexpected change in real interest rates, unexpected change in exchange rates, and the unexpected change in inflation.
CHAPTER SIX

6.1 INTRODUCTION

Having found that normality is comprehensively rejected, some of the alpha coefficients are positive and the share of unsystematic risk in total risk is generally high across the CAPM equations. In this chapter we begin to investigate whether these findings are associated with the fact that some important information related to the macroeconomic variables was not accommodated adequately into the CAPM equation leading to the presence of omitted variables. To be more precise, the analysis of the risk-return relationship in the previous chapter was carried out under the assumptions that all information is accommodated into the market index. However, there is a reason to believe that macroeconomic variables may have a separate effect over and above the market. The analysis of the effects of macroeconomic variables on market return is especially an important issue in the Saudi case because it is often argued that the Saudi economy has several characteristics that distinguish it from most of the countries and, therefore, CAPM may not be a suitable model.
As mentioned in Chapter 2, the Saudi Arabian economy, indeed, differs significantly from most other countries. Its first and the most important characteristics is that it is an oil-based economy, where oil produces more than 70% of government revenue. For this reason, the fluctuation of oil prices has a major impact on various activities in the economy including the stock market. Secondly, Saudi Arabia is an Islamic country where the majority of the people do not deal with interest. Thirdly, the exchange rate between Saudi riyals and the US dollar is fixed. Fourthly, inflation, generally, moves in a very narrow margin of inflation about 1% either way. For all these reasons, we need to consider the impact of those macroeconomic variables and identify the role they play in determining excess return in Saudi stock market indexes and individual companies. Furthermore, it is reasonable to expect that the impact of macroeconomic factors will vary from one sector to another and from one company to another since this is closely related to the input-output structure of the sectors and firms.

Therefore, the impact of these variables will be tested empirically by using the Arbitrage Pricing Model at the aggregate and disaggregate level. In this way, we will be able to identify the impact of each macroeconomic variable on each company’s return. Although finance theory does not provide any predetermined factors that influence excess return, we have selected the macroeconomic factors, which are subject to empirical analysis, based on the theoretical arguments provided in Chapter 3 and the availability of data. The factors, which will be used in empirical analysis, involve unexpected change in real oil prices, unexpected change in inflation, unexpected change in the money supply, unexpected change in the exchange rate of the Saudi riyal and the pound, sterling and unexpected change in the real interest rate.
The rest of this chapter is organised into four sections. Section 6.2 will cover the modelling framework and the definition of macroeconomic factors which are subject to empirical analysis. Section 6.3 will be devoted to a brief overview of the data. Section 6.4 will present the empirical results obtained in estimating the APT Model. The last section will summarise and conclude the chapter.
6.2 MODELLING FRAMEWORK

The model we are employing in this chapter is the *Arbitrage Pricing Model* which is a more general model compared to the CAPM. Detailed discussion of the model has already been given in Chapter Four. As mentioned there, the model, which is subject to empirical analysis, can be written as follows:

\[ r_{it} - r_{ft} = \alpha_i + \beta_1(r_{mt} - r_{ft}) + \beta_{urir} + \beta_{uropt} + \beta_{uex} + \beta_{uinf} + \beta_{dil} + \varepsilon_{it} \]  

where,

- \( r_{it} \) = Monthly return on the asset, obtained by subtracting the logarithm of the asset price index for firm \( i \) at time \( t \) from the logarithm of the asset price index for firm \( i \) at time \( t-1 \). \( i=1,2,...,51 \) and \( t=1,2,3,...,108 \),
- \( r_{ft} \) = Monthly returns to a risk-free asset at time \( t \), calculated as the 3-month interest rate of the Saudi riyal,
- \( \alpha_i \) = The constant term, which shows the return on asset \( i \) when the market-risk premium is zero,
- \( r_{mt} \) = Monthly return on the Saudi stock market, obtained by taking the log difference of the Saudi stock market index,
- \( urir_i \) = The unexpected change in real interest rate, calculated by taking the log difference of the actual real interest rate. Then the deviation from the mean. The real interest rate at time \( t \) is obtained by subtracting the 3-month interest rate on the Saudi riyal at time \( t \) from the inflation rate at time \( t \),
- \( urop_t \) = The unexpected change in real oil prices at time \( t \), obtained by taking the
log difference of the real oil prices, then the deviation from the mean. The real oil prices at time $t$ are calculated by deflating the oil prices index by the consumer price index at time $t$,

$$u_{ex_t} = \text{The unexpected exchange rate between the Saudi riyal and the pound sterling calculated by taking the log difference of the exchange rate index at time } t, \text{ then the deviation from the mean. In calculating unexpected exchange rates, the pound sterling exchange rate is used because the exchange rate between Saudi riyals and the dollar is fixed,}$$

$$u_{inf_t} = \text{The unexpected inflation, calculated by taking the deviation from the mean to the first difference between the percentage change in the consumer price index at time } t \text{ and the percentage change at time } t-1,$$

and

$$u_{m1} = \text{The unexpected change in the narrow measure of money supply } M1. \text{ This is calculated by taking the difference in the logarithm of } M1 \text{ between time } t \text{ and } t-1, \text{ then the deviation from the mean.}$$

In our empirical analysis, we estimate equation (6.1) for each company in addition to six market sector indexes. The contribution of each risk factor to the risk-free asset-returns will be assessed through regression coefficients, which will be generated from the model. Then we will employ the likelihood ratio test to verify the impact of unexpected change of five macroeconomic variables on excess returns. This involves the following null and alternative hypothesis:

$$H_0 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 = 0$$

$$H_1 : \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \neq 0$$
Failure to reject the null hypothesis would mean that the market index is capturing all changes in macroeconomic variables. This would also mean that the CAPM is enough to explain the excess return of various companies and market sector indexes. In addition, we try to explain if the impact on the sector index differs from the impact of individual companies. The test of the sectors presents the result for each sector in return.
6.3 PRELIMINARY OVERVIEW OF THE DATA

The purpose of this section is to familiarise ourselves with the Saudi stock market data that will be used in the empirical analysis by providing a brief overview of the data. A detailed analysis of the data and related statistical analysis of it has already been given in Chapter 4. As mentioned there, the data employed in this chapter is monthly time-series covering the period from 1991:5 to 2000:4 and tested for stationarity. The test results showed that they are all stationary. The data is collected mainly from the Saudi Arabian Monetary Agency quarterly reports, the shares control department in SAMA, and the Saudi Share Registration Company publications.

The classification employed in this work includes six sector indexes, and forty-five companies that correspond to six different sectors. Classification of the firms according to sectors is as follows:

*Sectored Market Indexes*

1. Bank Sector Index
2. Industrial Sector Index
3. Cement Sector Index
4. Services Sector Index
5. Electricity Sector Index
6. Agriculture Sector Index

*Bank Sector*

1. Riyadh Bank
2. Bank Al-Jazira
3. Saudi Investment Bank (SAIB)
4. Saudi Holland Bank (SHB)
5. Al Bank Al Saudi Al Fransi (BSF)
6. Saudi British Bank
7. Arab National Bank (ANB)
8. Al Rajhi Banking & Investment Co.

**Industrial Sector**
1. Saudi Basic Industries Co. (SABIC)
2. Saudi Arabia Fertiliser Co. (SAFCO)
3. Saudi Arabian Refiners Co. (SARCO)
5. Saudi Veg. Oil & Ghee Co. (SAVOLA)
6. National Industrial
8. National Gas Industrialisation Co. (GASCO)
10. Food Products Co.

**Cement Sector**
1. Arabian Cement Co. Ltd.
2. Yamamah Saudi Cement Co. Ltd
4. The Qassim Cement co.
5. Southern Providence Cement.
6. Yanbu Cement Co.
7. Eastern Providence Cement Co.

**Services Sector**
2. Saudi Real Estate Co.
4. Saudi Public Transport Co. (SAPTCO)
5. Saudi Automotive Services Co. (SASCO)
6. Al Mawashi & Al Mukairish Co.
7. Tihama Advertising & Public Relations Co.
9. Taibah Investment & Real Estate Co.
10. Mecca Investment & Real Estate Co.

**Electricity Sector**
2. Saudi Consol. Elec. Co. – SCECO-Western

**Agriculture Sector**
1. National Agriculture Development Co. (NADEC)
2. Gassim Agriculture Co. (GACO)
3. Hail Agriculture Development Co. (HADCO)
4. Tabouk Agriculture Development Co. (TADCO)
5. Saudi Fisheries Co.
6. Eastern Agriculture Development Co. (SHADCO)
7. Al Jouf Agriculture Development Co.
6.4 EMPIRICAL RESULTS

The primary concern of this section is to identify the determinants of market return based on the results obtained in estimating the APT model given in equation (6.1) at both the sectoral and firm level. The market return equations are estimated for six sectors and 45 companies listed in the Saudi stock market, making use of monthly time-series data over the period 1991:5-2000:4. The composition of firms in each sector is described in Section 6.3. We employed the ordinary least squares (OLS) estimation procedure in our empirical analysis. In the rest of this section, we first present the estimation results for the six sectors and then the results obtained in estimating the firm level market-return equations for each sector in turn.

6.4.1 Sectoral Market Return Equations

In this sub-section, we will present and comment on the results obtained in estimating the equation (6.1) for each of the six sectors. The estimation results and the corresponding summary and diagnostic statistics for each sector are presented in Table 6.1. These statistics include the adjusted $R^2$, the estimated standard error of the equation $\delta$ and statistics for a test of residual serial correlation $\chi^2_n$, functional form $\chi^2_h$, normality $\chi^2_n$ and heteroscedasticity $\chi^2_n$.

The results presented in Table 6.1 shed light on some important features of the determinants of market-return and the role of macroeconomic variables in this process. First, the market premium seems to be the most important factor. It explains
much of the variation in sectoral market return. The coefficients of the market
premium, which is also known as the market risk ($\beta_0$), are statistically significant and
positive for all sectors. While the $\beta_0$ is higher than one for the banking and industrial
sectors indicating that these sectors are riskier than the average risk of the entire
market, the corresponding $\beta_0$'s are less than one for the other four sectors.
Examination of the table shows that the electricity and agricultural sectors are the
least risky sectors in the Saudi stock market.

Secondly, the macroeconomic variables varied on their effects on various sectors. In
the banking sectoral return, both unexpected change in the narrow defined money
supply and unexpected change in the exchanged rate have a positive and statistically
significant effect at a 1% level of significance. This positive effect seems logical as an
increase in the money supply would mean an increase of personal deposits which
would reflect positively on banks profits. Fluctuation of the exchange rate is
important, since all Saudi banks invest their deposits in the international market as
legislative environment does not encourage domestic.
The variation of industrial sectoral return is explained by unexpected change in the
money supply, unexpected change in the exchange rate, and unexpected change in
inflation over and above the market return. Unexpected change in the money supply
and exchange rate has a negative effect at 10% level of significance while unexpected
inflation has a positive effect. The negative sign in the exchange rate can be
understood as this sector may depend on exports to other countries. The positive sign
for inflation can be considered as one of the anomalies explained in Chapter 3 while a
negative money supply effect is contradicting in the literature. However, we must bear
in mind that there are some companies that have a weight in the sectoral index which
is concentrated in the hands of only a few investors, and this may have some impact on the result.

However, other macroeconomic variables have no effect on sectoral return. The coefficients of these variables are insignificant for all other sectors, and have different signs than those expected in many other cases.

Although we expect that the oil prices have a positive and significant effect on sectoral return, it seems that the information on oil prices has been adequately accommodated into the market premium and therefore this effect has already been captured by the coefficient of the market premium ($\beta_0$).

Thirdly, we also tested statistically whether market risk is entirely captured by the market risk premium. Using a 10% level of significance, we tested the joint null hypothesis that the coefficients of the five macroeconomic variables are simultaneously equal to zero. The results from the LR tests are presented in Table 6.1. Examination of the LR test result shows that systematic risk is entirely captured by the market risk premium for four sector indexes out of six. The result from the LR test showed that the null hypothesis was rejected for the banking sector index at a 1% level of significance and a 10% level of significance in the industrial sector. The null hypothesis could not be rejected for other sectors. This indicates that unexpected changes in macroeconomic variables have no impact on risk-free returns for all other sectors.

Fourthly, examination of the results also shows that sectors differ significantly in terms of sector-specific risks. As mentioned before, $1 - R^2$ measures the percentage of sector-specific risk in total risk. In this sense, among the six sectors, while the
electricity sector is the one which has the highest unsystematic risk or sector-specific risk, the banking sector has the lowest specific risk. In the same way, $R^2$ gives the proportion of non-diversifiable risk in total risk. Examining the results from this perspective shows that the risk factors in equation (6.1) explain a significant amount of variation in returns in the banking sector compared to the electricity sector.

However, the explanatory power for the equation has improved by 2% on average compared to the CAPM model as the $R^2$ for banking sector has increased from 86% to 88%, in the industrial sector from 78% to 80%, in the cement sector from 47.8% to 49%, in the services sector from 58% to 62%, in the electricity sector from 22% to 25%, and in the agriculture sector from 45.5% to 47%.

Finally, the intercept term is not statistically significant for only the industrial sector, but is positive and statistically significant for the banking sector. The intercept is statistically significant and negative for rest of the sectors.

Having presented and discussed the results from the sectoral return equations, we now turn our attention to the disaggregated return equations by firms. For a number of reasons, the results from the studies, which were carried out making use of the data aggregated at the sectoral level, might be misleading. As shown by Lee, Pesaran and Pierse (1990), the studies undertaken at the aggregate level may suffer from aggregation bias in the estimated parameters of the aggregate equation. Aggregate analysis of data may lead to biased results because firms' returns differ significantly in terms of their responsiveness to macroeconomic variables. Furthermore, sectoral analysis of data obscures the relationship between firms' returns and macroeconomic variables. Considering these, in the rest of the section, we will investigate the risk-
return relationship at the firm level for each sector and then compare these findings with the corresponding sectoral results presented in the previous sub-section.

<table>
<thead>
<tr>
<th>Sectors</th>
<th>$\alpha_i$</th>
<th>$\beta_{oi}$</th>
<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
<th>$R^2$</th>
<th>$\delta$</th>
<th>$X^2_{sc}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banks Sector Index</td>
<td>0.01</td>
<td>1.15</td>
<td>0.29</td>
<td>-0.32</td>
<td>0.22</td>
<td>0.03</td>
<td>-0.02</td>
<td>0.88</td>
<td>0.22</td>
<td>(7.21)</td>
</tr>
<tr>
<td></td>
<td>(3.38)*</td>
<td>(26.3)*</td>
<td>(2.96)*</td>
<td>(-1.02)</td>
<td>(2.7)*</td>
<td>(0.19)</td>
<td>(-0.66)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Sector  Index</td>
<td>0.00</td>
<td>1.09</td>
<td>-0.22</td>
<td>0.74</td>
<td>-0.18</td>
<td>0.10</td>
<td>0.02</td>
<td>0.80</td>
<td>0.03</td>
<td>(15.3)</td>
</tr>
<tr>
<td></td>
<td>(1.14)</td>
<td>(20.0)*</td>
<td>(-1.80)***</td>
<td>(1.92)***</td>
<td>(-1.82)**</td>
<td>(0.47)</td>
<td>(0.39)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement Sector Index</td>
<td>-0.01</td>
<td>0.81</td>
<td>-0.16</td>
<td>-0.94</td>
<td>-0.14</td>
<td>0.04</td>
<td>-0.05</td>
<td>0.49</td>
<td>0.04</td>
<td>(19.8)***</td>
</tr>
<tr>
<td></td>
<td>(-1.98)***</td>
<td>(9.51)*</td>
<td>(-0.83)</td>
<td>(-1.57)</td>
<td>(-0.89)</td>
<td>(0.12)</td>
<td>(-0.81)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services Sector Index</td>
<td>-0.11</td>
<td>0.92</td>
<td>-0.28</td>
<td>-0.63</td>
<td>-0.20</td>
<td>-0.25</td>
<td>-0.06</td>
<td>0.62</td>
<td>0.04</td>
<td>6.22</td>
</tr>
<tr>
<td></td>
<td>(-2.14)**</td>
<td>(12.2)*</td>
<td>(-1.65)</td>
<td>(-1.18)</td>
<td>(-1.44)</td>
<td>(-0.83)</td>
<td>(-1.09)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity Sector Index</td>
<td>-0.02</td>
<td>0.58</td>
<td>-0.21</td>
<td>0.68</td>
<td>-0.15</td>
<td>-0.22</td>
<td>0.07</td>
<td>0.25</td>
<td>0.05</td>
<td>4.71</td>
</tr>
<tr>
<td></td>
<td>(-2.99*)</td>
<td>(5.49)*</td>
<td>(-0.92)</td>
<td>(0.92)</td>
<td>(-0.76)</td>
<td>(-0.54)</td>
<td>(0.89)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture Sector Index</td>
<td>-0.03</td>
<td>0.59</td>
<td>-0.12</td>
<td>-0.20</td>
<td>0.00</td>
<td>-0.40</td>
<td>-0.01</td>
<td>0.047</td>
<td>0.03</td>
<td>(4.40)</td>
</tr>
<tr>
<td></td>
<td>(-7.30*)</td>
<td>(8.97)*</td>
<td>(-0.83)</td>
<td>(-0.44)</td>
<td>(0.00)</td>
<td>(-1.54)</td>
<td>(-0.12)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Coefficients refer to the following regression: $r_t - r_f = \alpha_i + \beta_{oi}(r_{mt} - r_f) + \beta_{1i}ur_{it} + \beta_{2i}ur_{op} + \beta_{3i}u_{ext} + \beta_{4i}ur_{inf}$, where $\alpha_i$ are t-statistics. One (*) star shows that they are significant at the 1% level, two (**) indicate that they are significant at 5% level, and three (***) at 10% level. Variable definitions are provided in the text and their sources given in Chapter 4. $R^2$ is the square of the multiple correlation error. $\chi^2_{sc}(1)$ is the first order LM test of serial correlation, $\chi^2_{bf}(1)$ is the test of functional form, $\chi^2_{N}(2)$ is the test of Normal heteroscedasticity. LR is the LR test statistics carried out on the null hypothesis of $H_0: \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 = 0$. One (*) star shows that they are significant at 1% level, two (**) indicate that they are significant at 5% level, and three (***) indicate that they are significant at 10% level.
6.4.2 Banking Sector Market Returns

The estimation results for the firms in the banking sector are presented in Table 6.2. The most important features of the determinants of the banks' returns and the macroeconomic variables are as follows. Firstly, examination of the LR test results shows that systematic risk is entirely captured by the market risk premium for almost all banks. We tested jointly the null hypothesis that the coefficients of the five macroeconomic variables are simultaneously equal to zero. The result from the LR test showed that the null hypothesis was rejected for only Al-Jazira bank at 10% level of significance while the null hypothesis could not be rejected for the rest of banks indicating that surprise variables have no impact on risk-free returns for all seven banks.

Secondly, the coefficient of the market premium, $\beta_{0i}$, is statistically significant and positive for all banks. $\beta_{0i}$ is higher than one for six banks out of eight, which indicates that these banks are riskier than the average risk of the general market index. The corresponding $\beta_{0i}$'s are less than one of two banks, which are Al-Rajhi and Al-Hollandi. The systematic part of the total risk is exclusively explained by changes in market premium for two banks, namely Arab National Bank and Al-Rajhi Bank.

Thirdly, the other risk factors (apart from the market premium) which are proxies by five different macroeconomic variables, performed differently and banks varied in their response to these factors. The exchange rate appears to be the second important factor in explaining the systematic part of total risk for three banks, namely the Investment Bank, Al-Jazeera Bank, and Al-Hollandi Bank. The coefficient of exchange rate, $\beta_{3i}$, is statistically significant and positive for all three banks.
As has been mentioned earlier, the legislative environment, which banks work within, encourages them to invest their money in foreign currencies and the international market. The three banks mentioned above are the smallest in the country and the shareholders of two of them are very limited. This also encourages them to work as private investment houses to shareholders. Other macro-economic factors also have some impact on other banks as the money supply has a significant and positive effect for the Saudi British Bank at a 5% level of significance. The reason that the Saudi British Bank is sensitive to unexpected changes in money supply may be related to its big share of the market.

The unexpected real interest rate is significant and has a negative for the Saudi Hollandi Bank. Again, the nature of this bank and its activities as a private investment institution could explain its sensitivity to factors like exchange rates and interest rates. However, consistent with the financial literature higher interest rates have a negative effect on share prices. This would explain the negative relationship between an unexpected real interest rate and a bank’s expected return.

Unexpected inflation has no effect on return for all banks. This can be related to the nature of the banking sector and the low rate of inflation in Saudi Arabia.

Unexpected change in oil prices has a significant and positive effect at 10% level on Al-Jazira Bank. The reason behind this may be attributed to either the nature of customers of this bank; most of them are farmers who depend on government subsidies, or its small size which makes it sensitive to any change in the macro economy. Al-Jazera bank is the only bank with a return sensitive to three factors in addition to the market risk premium.
Based on the above result, the question may be raised as to why unexpected oil prices have no effect on banks when the Saudi economy depends on oil to the level of 30% of its GDP.

The answer could be as follows:

1. As mentioned earlier, oil is owned by the government and oil companies are not listed in the stock market and not calculated against the general market index, so the impact of unexpected oil prices comes from its influence on other market sectors. This impact might be captured by the market index.

2. The nature of the government expenditure which is distributed among public administration, defence and public services such as health and education limit the impact of oil on the private sector and the stock market.

3. The growth of debt in the Saudi economy allows the government, in the event of higher oil revenues, not only to absorb the debt but pay interest on it as well.

4. The private sector is becoming more mature and independent. This applies particularly to the banking sector which has become more sensitive to other macroeconomic fundamentals such as exchange rates and interest rates rather than oil.

Finally, the specific risk measured by $1-R^2$ differs significantly among the banks. Riyadh Bank seems to have the lowest specific risk with 36% while the company-specific risk for Saudi Investment Banks consists of 66% of total risk. For other banks, diverseable risk involves 45%-55% of their total risk. However, when we
compare $R^2$ using the APT model to the CAPM model, we find that it increases from 43% to 48% for Al-Jazira Bank, from 36% to 41% for Saudi Hollandi Bank, and at an average of 2% for the rest of the banks.

The intercept term is not statistically significant for any of the banks except for Riyadh Bank at a 1% level of significance.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_{0i}$</th>
<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
<th>$R^2$</th>
<th>$\delta$</th>
<th>$X^2_{sc}$</th>
<th>$X^2_f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riyadh Bank</td>
<td>0.02</td>
<td>(3.01)*</td>
<td>1.43</td>
<td>(13.1)*</td>
<td>0.32</td>
<td>(1.30)</td>
<td>0.41</td>
<td>(-0.05)</td>
<td>0.08</td>
<td>-0.04</td>
<td>0.64</td>
</tr>
<tr>
<td>Bank Al-Jazira</td>
<td>0.00</td>
<td>(0.40)</td>
<td>1.32</td>
<td>(8.45)*</td>
<td>0.38</td>
<td>(1.09)</td>
<td>0.25</td>
<td>(0.23)</td>
<td>0.68</td>
<td>-0.25</td>
<td>0.48</td>
</tr>
<tr>
<td>S. Invest Bank(SAIB)</td>
<td>0.02</td>
<td>(1.37)</td>
<td>1.13</td>
<td>(6.63)*</td>
<td>0.02</td>
<td>(0.04)</td>
<td>0.44</td>
<td>(0.37)</td>
<td>0.63</td>
<td>0.33</td>
<td>0.34</td>
</tr>
<tr>
<td>Saudi Holland Bank (SHB)</td>
<td>0.01</td>
<td>(1.30)</td>
<td>0.93</td>
<td>(7.13)*</td>
<td>0.22</td>
<td>(0.76)</td>
<td>-1.30</td>
<td>(-1.41)</td>
<td>0.38</td>
<td>-0.96</td>
<td>0.41</td>
</tr>
<tr>
<td>Saudi Al Fransi(BSF)</td>
<td>0.01</td>
<td>(0.73)</td>
<td>1.07</td>
<td>(9.62)*</td>
<td>0.38</td>
<td>(1.57)</td>
<td>0.11</td>
<td>(0.14)</td>
<td>0.44</td>
<td>-0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Saudi British Bank</td>
<td>0.01</td>
<td>(1.45)</td>
<td>1.21</td>
<td>(9.49)*</td>
<td>0.62</td>
<td>(2.18)**</td>
<td>0.43</td>
<td>(0.48)</td>
<td>0.20</td>
<td>0.02</td>
<td>0.51</td>
</tr>
<tr>
<td>Arab National (ANB)</td>
<td>0.01</td>
<td>(1.34)</td>
<td>1.31</td>
<td>(11.0)*</td>
<td>0.25</td>
<td>(0.96)</td>
<td>0.74</td>
<td>(0.88)</td>
<td>0.29</td>
<td>-0.15</td>
<td>0.57</td>
</tr>
<tr>
<td>Al Rajhi Banking &amp;</td>
<td>-0.003</td>
<td>(-0.51)</td>
<td>0.94</td>
<td>(9.26)*</td>
<td>0.10</td>
<td>(0.43)</td>
<td>0.51</td>
<td>(0.71)</td>
<td>0.22</td>
<td>0.22</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Notes: see notes from Table 6.1.
6.4.3 Industrial Sector Market Returns

Results for the industrial sector are presented in Table 6.3. From the table we can extract the following features. First, the LR test results presented in Table 6.3 show that the null hypothesis, that the coefficients of the five macroeconomic variables are simultaneously equal to zero, could not be rejected for all companies in the industrial sector, except for Ceramic Company. This implies that, except for this company, market risk is entirely captured by the market risk premium.

Secondly, the market risk premium seems to be the most important factor in determining return for eight out of ten companies in the industrial sector, where the coefficient of the risk free market premium variable is statistically significant and positive for all eight companies. Further analysis of the results for these companies shows that $\beta_{0i}$ is higher than one for three companies in the sector, namely SABIC, SAFCO and National Industrial. The corresponding $\beta_{0i}$ for the other five companies is less than one implies that these companies have a lower risk than the average risk of the entire market. However, the only companies in which market risk is not statistically significant are Saudi Refineries and National Gypsum. This finding will be examined when we discuss the impact of macroeconomic variables.

Thirdly, the macroeconomic variables have no effect on six companies in the industrial sector indicating that the market risk premium is capturing the unexpected changes in macroeconomic variables. The other four companies responded differently to unexpected changes in macroeconomic variables. While Saudi Refinery and National Gypsum have a significant negative relationship with unexpected changes in
the real interest rate at a 1% level of significance, Saudi Ceramic has a similar relationship but at a 5% level of significance. Actually, this relationship with the interest rate may allow us to make some interpretation about the behaviour of these companies’ returns and their lack of a significant relationship with market risk premium.

As we have mentioned earlier, the number of shareholders in these companies is limited; 550 for National Gypsum and 1038 for Refinery. The number of shares traded for the first six months of the year 2000 was 90307 for National Gypsum and 10844 for Saudi Refinery. This may indicate that the shares of these companies are not used for trading but as a deposit or guarantee for loans but in order to use the facilities available to them at the banks; lower interest rates would encourage the owners of these companies’ shares to increase the amount they borrow from the banks while pushing up the values of their shares. On the other hand, high interest rates would mean that the market itself would decide the price. The same logic can be applied to Saudi Ceramic which has only 1225 share holders. However, National Gypsum has significant negative relationship with unexpected change in exchange rates. This may be related to the ability of the company to export.

Fourthly, the result also shows that company specific risk measured by $1-R^2$ differs significantly among companies. $1-R^2$ also indicates that the amount of change in companies risk premium could not be explained by the changes in all right-hand variables. The examination of the result shows that, among the 10 companies, both National Gas and Saudi Refinery have the highest unsystematic risk while SABIC has the lowest. It is also worth mentioning that the intercept term was statistically
significant and negative for seven companies which mean that these companies are over-priced. The constant term is not significant for the following three: SABIC, SAFCO, and National Industrial.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_{0i}$</th>
<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
<th>$R^2$</th>
<th>$\sigma$</th>
<th>$\chi^2_{sc}$</th>
<th>$X^2_{sc}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Basic Industries Co. (SABIC)</td>
<td>0.01</td>
<td>1.20</td>
<td>0.22</td>
<td>0.12</td>
<td>0.29</td>
<td>0.04</td>
<td>0.05</td>
<td>0.46</td>
<td>0.07</td>
<td>(11.7)</td>
<td>(0.3)</td>
</tr>
<tr>
<td>Saudi Arabia Fertiliser Co. (SAFCO)</td>
<td>0.00</td>
<td>1.09</td>
<td>-0.12</td>
<td>0.78</td>
<td>0.10</td>
<td>0.54</td>
<td>-0.13</td>
<td>0.34</td>
<td>0.08</td>
<td>(19.7)***</td>
<td>(0.0)</td>
</tr>
<tr>
<td>Saudi Arabian Refiners Co. (SARCO)</td>
<td>-0.05</td>
<td>0.15</td>
<td>-0.11</td>
<td>-0.20</td>
<td>-0.04</td>
<td>-0.90</td>
<td>0.05</td>
<td>0.08</td>
<td>0.05</td>
<td>(6.24)</td>
<td>(0.2)</td>
</tr>
<tr>
<td>Saudi Ceramic Co.</td>
<td>-0.04</td>
<td>0.43</td>
<td>0.65</td>
<td>-1.00</td>
<td>0.12</td>
<td>-1.44</td>
<td>0.04</td>
<td>0.19</td>
<td>0.07</td>
<td>(15.96)</td>
<td>(0.0)</td>
</tr>
<tr>
<td>Saudi Veg. Oil &amp; Ghee Co. (SAVOLA)</td>
<td>-0.02</td>
<td>0.63</td>
<td>-0.22</td>
<td>0.34</td>
<td>-0.13</td>
<td>-0.50</td>
<td>0.07</td>
<td>0.23</td>
<td>0.06</td>
<td>(17.11)</td>
<td>(4.4)</td>
</tr>
<tr>
<td>National Industrial</td>
<td>0.00</td>
<td>1.19</td>
<td>-0.67</td>
<td>0.45</td>
<td>-0.24</td>
<td>0.18</td>
<td>0.18</td>
<td>0.31</td>
<td>0.10</td>
<td>(9.81)</td>
<td>(0.0)</td>
</tr>
<tr>
<td>Saudi Pharmaceutical Indus Corp.</td>
<td>-0.02</td>
<td>0.81</td>
<td>0.54</td>
<td>-0.20</td>
<td>-0.16</td>
<td>-0.12</td>
<td>0.15</td>
<td>0.34</td>
<td>0.06</td>
<td>(10.7)</td>
<td>(0.0)</td>
</tr>
<tr>
<td>National Gas Industrialisation Co. (GASCO)</td>
<td>-0.03</td>
<td>0.34</td>
<td>0.05</td>
<td>0.60</td>
<td>-0.18</td>
<td>-0.24</td>
<td>0.12</td>
<td>0.09</td>
<td>0.07</td>
<td>(9.94)</td>
<td>(0.0)</td>
</tr>
<tr>
<td>National Gypsum Co.</td>
<td>-0.05</td>
<td>-0.08</td>
<td>-0.28</td>
<td>-0.15</td>
<td>-0.97</td>
<td>-0.91</td>
<td>0.07</td>
<td>0.21</td>
<td>0.08</td>
<td>(2.62)</td>
<td>(32.7)</td>
</tr>
<tr>
<td>Food Products Co</td>
<td>-0.02</td>
<td>0.84</td>
<td>-0.15</td>
<td>-0.94</td>
<td>0.18</td>
<td>-0.76</td>
<td>0.10</td>
<td>0.33</td>
<td>0.07</td>
<td>(8.58)</td>
<td>(1.0)</td>
</tr>
</tbody>
</table>

Notes: see notes from Table 6.1.
6.4.4 Cement Sector Market Returns

Looking at the cement sector which consists of seven companies, we can conclude that the market premium is the most effective element in deciding companies' returns. The market risk, $\beta_{0i}$, is statistically significant and positive for all companies in the sector. All companies in the cement sector have a $\beta_{0i}$ value lower than one indicating that these companies have less risk compared to the average risk for the entire market.

Looking at the impact of unexpected change in the macroeconomic variables on companies' return we can notice that unexpected inflation is significant with a negative sign at a 10% level for the Saudi Cement Company and for Yanbu at 5% level of significance. Unexpected change in exchange rates is also significant with a negative sign at 1% in the case of Southern Company. This relationship may reflect the influence of the export activities on this company's profits. Other than that, the macroeconomic variable has no impact on any company in that sector. Again, we would say that the reason for this has already been captured by the market premium.

When we tested statistically whether market-risk was entirely captured by the market risk premium using the joint null hypothesis that the coefficient of the five macroeconomic variables was simultaneously equal to zero, we found that the null hypothesis was not rejected for all companies implying that the market risk was entirely captured by the market risk premium for all companies.

The examination of $1-R^2$ which measures the size of company specific risk, showed that all the cement companies have around 70% unsystematic risk and 30% systematic
risk except for the Qassim Cement Company where almost 85% of the risk is related
to the company and the rest is systematic risk. Examination of the standard error of
regression indicates that the amount of change in company risk-premium cannot be
explained by changes in all of the right hand variables. The examination shows that
the standard error of residuals vary from 6% for the Southern Cement Company to 9%
for Yanbu. The intercept is negative at a 1% level of significant for Qassim Cement
indicating that this company is over-priced.
<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_{0i}$</th>
<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
<th>$R^2$</th>
<th>$\sigma$</th>
<th>$X^2_{sc}$</th>
<th>$X^2_{ur}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabian Cement Co. Ltd.</td>
<td>-0.014</td>
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<td>0.04</td>
<td>0.66</td>
<td>-0.19</td>
<td>-0.24</td>
<td>0.08</td>
<td>0.31</td>
<td>0.07</td>
<td>(11.7)</td>
<td>(0.07)</td>
</tr>
<tr>
<td></td>
<td>(-1.49)</td>
<td>(6.55)*</td>
<td>(0.14)</td>
<td>(0.68)</td>
<td>(-0.76)</td>
<td>(-0.44)</td>
<td>(0.79)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yamamah S. Cement Co. Ltd</td>
<td>-0.01</td>
<td>0.75</td>
<td>-0.17</td>
<td>-0.81</td>
<td>-0.16</td>
<td>0.02</td>
<td>-0.03</td>
<td>0.26</td>
<td>0.07</td>
<td>(12.2)</td>
<td>(0.04)</td>
</tr>
<tr>
<td></td>
<td>(-1.43)</td>
<td>(5.68)*</td>
<td>(-0.58)</td>
<td>(-0.86)</td>
<td>(-0.66)</td>
<td>(0.03)</td>
<td>(-0.26)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Saudi Cement Co.</td>
<td>-0.01</td>
<td>0.78</td>
<td>-0.12</td>
<td>-1.45</td>
<td>-0.22</td>
<td>-0.42</td>
<td>-0.12</td>
<td>0.33</td>
<td>0.06</td>
<td>(6.93)</td>
<td>(2.31)</td>
</tr>
<tr>
<td></td>
<td>(-1.46)</td>
<td>(6.44)*</td>
<td>(-0.45)</td>
<td>(-1.71)***</td>
<td>(-0.99)</td>
<td>(-0.89)</td>
<td>(-1.31)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qassim Cement Co.</td>
<td>-0.03</td>
<td>0.43</td>
<td>-0.07</td>
<td>-1.22</td>
<td>-0.33</td>
<td>0.17</td>
<td>-0.04</td>
<td>0.14</td>
<td>0.06</td>
<td>(15.2)</td>
<td>(0.06)</td>
</tr>
<tr>
<td></td>
<td>(-3.25)*</td>
<td>(3.58)*</td>
<td>(-0.26)</td>
<td>(-1.44)</td>
<td>(-1.50)</td>
<td>(0.36)</td>
<td>(-0.45)</td>
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</tr>
<tr>
<td>Southern Providence Cement</td>
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<td>0.06</td>
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<td>-0.36</td>
<td>0.12</td>
<td>0.03</td>
<td>0.31</td>
<td>0.06</td>
<td>(6.08)</td>
<td>(0.06)</td>
</tr>
<tr>
<td></td>
<td>(-1.59)</td>
<td>(6.45)*</td>
<td>(0.224)</td>
<td>(-0.53)</td>
<td>(-1.70)***</td>
<td>(0.25)</td>
<td>(0.29)</td>
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<td></td>
</tr>
<tr>
<td>Yanbu Cement Co.</td>
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<td>0.90</td>
<td>0.37</td>
<td>-2.64</td>
<td>-0.06</td>
<td>0.10</td>
<td>0.03</td>
<td>0.27</td>
<td>0.09</td>
<td>(12.4)</td>
<td>(8.81)</td>
</tr>
<tr>
<td></td>
<td>(-0.95)</td>
<td>(5.28)*</td>
<td>(0.98)</td>
<td>(-2.18)***</td>
<td>(-0.19)</td>
<td>(0.14)</td>
<td>(0.24)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Providence Cement Co.</td>
<td>-0.01</td>
<td>0.80</td>
<td>-0.23</td>
<td>0.03</td>
<td>-0.14</td>
<td>-0.12</td>
<td>-0.09</td>
<td>0.32</td>
<td>0.06</td>
<td>(9.22)</td>
<td>(0.10)</td>
</tr>
<tr>
<td></td>
<td>(-0.60)</td>
<td>(6.77)*</td>
<td>(-0.86)</td>
<td>(0.03)</td>
<td>(-0.65)</td>
<td>(-0.25)</td>
<td>(-1.04)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: see notes from Table 6.1.
6.4.5 Service Sector Market Returns

The service sector consists of 10 companies, which is the same number of companies as in the industrial sector. But going back to Table 6.5 in Chapter Two we will find that the number of shares traded in this sector is the highest compared to other sectors. The reason for this is because some companies in this sector are engaged in speculating. Al-Mawashi, for example, is considered to be one of the most traded companies in the market (50 million shares in the first six months of year 2000). This high volume of trading makes Al-Mawashi the riskiest share in the entire market with a coefficient of market risk premium equal to 1.51. This high volume of trade can be attributed to speculation in this company and some other companies, like Taibah and Saudi National Shipping. Speculation on these companies started as a result of assigning brokerage services to the banks and the introduction of the Electronic Shares Information System (ESIS). These arrangements left tens of unlicensed trading offices (mentioned earlier) with hundreds of thousands shares to sell and the only way to sell them was through ESIS but over of these shares at once lowered their price so the only way to maintain the price level was by continuous buying and selling of these shares while benefiting from the margin between the two prices.

Going back to Table 6.5 which presents the results from equation (6.1) as applied to the companies listed in this sector. Examination of the table reveals significant clues about the determinants of return in the services sector. The first of these insights is related to the impact of surprise variables on company returns in the sector. We tested the joint null hypothesis that the coefficients of the macroeconomic
variables are simultaneously equal to zero by using the LR test. The results show that
the null hypothesis is rejected for four companies, namely Al-Mawashi, Thiama, Assir
and Taiba, while it is not rejected for the other six companies in the services sector.
Secondly, the market risk premium is the most important factor in determining
companies’ returns in the service sector. The coefficient of the market risk premium
\( \beta_{0i} \) is statistically significant and positive for all companies in the sector. The \( \beta_{0i} \)
coefficient is higher than one for three companies all of which are speculating
companies, namely Al-Mawashi, National Shipping, and Taiba. This means that the
risks for these companies’ are higher than the average risk of the market. The other
seven companies have \( \beta_{0i} \) of less than one, which means that they have less risk over
the general market index. The least risky company in this sector seems to be Saudi
Real Estate with \( \beta_{0i} \) equal to 0.45.

Thirdly, macroeconomic variables were significant in general with a negative effect
especially in the speculation companies. Unexpected change in money supply had a
negative effect on the Automotive Company, (SASCO), at a 5% level of significance
and Al-Mawashi at 10%. Unexpected inflation has a negative effect at a 1% level of
significance for Tihamah and at 10% for Taiba. Unexpected change in the exchange
rate also had a negative effect on Taiba and Assir. Unexpected change in the real
interest rate had a significant negative effect on both Tihamah and Assir at a 1% level
of significance. Finally, the unexpected change of real oil prices had a negative effect
on Al-Mawashi at a 1% level of significance. However, this negative relation between
unexpected change of oil prices and Al-Mawashi may have only one interpretation:
speculators may have taken the opportunity of the increase in oil prices and the
increase in the price of their shares to sell them. However, the unexpected change in oil prices had a positive effect on Taiba Company at a 10% level of significance. Fourthly, examination of results also shows that companies in the service sector differ significantly in terms of company-specific risk as most of the companies have a 70-80 company-specific risk, while the rest have systematic risk. The Tihamah Company seems to have the lowest systematic risk at 19% while Public Transport has the highest in this sector with 40%. The intercept term in not statistically significant. It is negative for four companies and statistically insignificant for the other six.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_{0i}$</th>
<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
<th>$R^2$</th>
<th>$\delta$</th>
<th>$X^2_{sc}$</th>
<th>$X^2_{fe}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Hotels &amp; Resort Areas. Co.</td>
<td>-0.02</td>
<td>0.60</td>
<td>-0.002</td>
<td>0.79</td>
<td>-0.03</td>
<td>-0.15</td>
<td>0.07</td>
<td>0.24</td>
<td>0.06</td>
<td>(10.9)</td>
<td>(0.67)</td>
</tr>
<tr>
<td></td>
<td>(-3.01)*</td>
<td>(5.39)*</td>
<td>(-0.01)</td>
<td>(1.01)</td>
<td>(-1.13)</td>
<td>(-1.34)</td>
<td>(0.87)</td>
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<td></td>
</tr>
<tr>
<td>Saudi Real Estate Co.</td>
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<td>0.45</td>
<td>0.06</td>
<td>0.43</td>
<td>-0.05</td>
<td>-0.49</td>
<td>0.03</td>
<td>0.20</td>
<td>0.05</td>
<td>(9.59)</td>
<td>(0.67)</td>
</tr>
<tr>
<td></td>
<td>(-4.70)*</td>
<td>(4.63)*</td>
<td>(0.29)</td>
<td>(0.63)</td>
<td>(-1.27)</td>
<td>(-1.28)</td>
<td>(0.41)</td>
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<tr>
<td>Saudi National Shipping Co.</td>
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<td>1.16</td>
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<td>0.17</td>
<td>0.02</td>
<td>0.38</td>
<td>0.08</td>
<td>(15.9)</td>
<td>(3.70)*</td>
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<td></td>
<td>(-0.50)</td>
<td>(7.62)*</td>
<td>(-0.88)</td>
<td>(1.90)**</td>
<td>(-0.97)</td>
<td>(0.29)</td>
<td>(0.17)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Saudi Public Transport Co. (SAPTCO)</td>
<td>-0.02</td>
<td>0.64</td>
<td>-0.23</td>
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<td>-0.19</td>
<td>-0.53</td>
<td>-0.01</td>
<td>0.40</td>
<td>0.04</td>
<td>(7.20)</td>
<td>(0.42)</td>
</tr>
<tr>
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<td>(7.75)*</td>
<td>(-1.23)</td>
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<td>(-1.25)</td>
<td>(-1.64)</td>
<td>(-0.18)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>S. Automotive Services Co. (SASCO)</td>
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<td>-0.70</td>
<td>1.00</td>
<td>-0.22</td>
<td>-0.29</td>
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<td>0.07</td>
<td>(7.53)</td>
<td>(1.48)</td>
</tr>
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<td>(7.15)*</td>
<td>(-2.29)**</td>
<td>(1.04)</td>
<td>(-0.90)</td>
<td>(-0.54)</td>
<td>(-0.70)</td>
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</tr>
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<td>0.11</td>
<td>(17.6)</td>
<td>(0.03)</td>
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<tr>
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<td>(1.16)</td>
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<td>(-1.77)**</td>
<td>(0.03)</td>
<td>(0.63)</td>
<td>(-0.49)</td>
<td>(-2.66)*</td>
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</tr>
<tr>
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<td>0.19</td>
<td>0.12</td>
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<td>(2.42)</td>
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<td>(2.39)**</td>
<td>(1.06)</td>
<td>(-2.65)*</td>
<td>(1.27)</td>
<td>(-1.77)**</td>
<td>(1.01)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Assir Trading, Tourism &amp; Manufacturing</td>
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<td>-0.41</td>
<td>-1.42</td>
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<td>(-1.38)</td>
<td>(-1.79)**</td>
<td>(-2.83)*</td>
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</tr>
<tr>
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<td>-0.01</td>
<td>-0.75</td>
<td>-0.27</td>
<td>0.22</td>
<td>0.38</td>
<td>0.09</td>
<td>(7.74)</td>
<td>(5.54)</td>
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<td>(-1.13)</td>
<td>(-0.01)</td>
<td>(-2.45)**</td>
<td>(-0.41)</td>
<td>(0.67)**</td>
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</tr>
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<td>0.07</td>
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<td>0.07</td>
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<td>(1.56)</td>
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<td>(-0.47)</td>
<td>(-1.72)**</td>
<td>(-0.98)</td>
<td>(0.12)</td>
<td>(0.09)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: see notes from Table 6.1.
6.4.6 Electricity Sector Market Returns

The electricity sector consists of three companies. The estimation results for the firms in the electricity sector are presented in Table 6.6. The most important features of the determinant of the electricity return and the macroeconomic variables are as follows. Firstly, examination of likelihood ration test LR results shows that systematic risk in entirely captured by the market risk premium for two companies namely SCECO-Central and SCECO-Eastern. The null hypothesis that the coefficients of the five macroeconomic variables are simultaneously equal to zero was rejected for SCECO-Western.

Secondly, all companies in the electricity sector have a statistically significant and positive market risk, $\beta_{01}$. The $\beta_{01}$’s for all companies are less than one and range around 0.5. The value of $\beta_{01}$ indicates that companies in this sector have 50% less than the average market risk. Looking at the coefficient of the macroeconomic variables, while we observe that unexpected change of the real interest rate had a negative effect on the Central Province Electric Company at a 10% level of significance; it had a positive effect on the Western Province Electric Company at a 5% level of significance. These results may indicate the type of financial problems facing these companies since they are dependent on government subsidies. The increase in oil prices means that the subsidies will be paid so they have to live on loans. Another factor that had a significant and positive effect on the Western Province Company was the unexpected change of inflation. This positive effect can be attributed to the inflation in Saudi Arabia which was caused by increased public utilities’ prices which may have increased the revenues of these companies.
Examining $1-R^2$ which measures the size of company-specific risk shows that all companies have very high specific-risk ranging around 80% while systematic risk is about 20%. The standard deviation of the regression indicates that the amount of change in the sectors' risk premium could not be explained by the changes in all of the right hand side variables. The result shows that the standard error of residual varies between 5% and 6%. Finally, the intercept term is statistically significant and negative for all companies in the electricity sector. This indicates that these companies are over priced.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_{0i}$</th>
<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
<th>$R^2$</th>
<th>$\sigma$</th>
<th>$X^2_{sc}$</th>
<th>$LL$</th>
</tr>
</thead>
<tbody>
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<td>Saudi Consol. Elec. Co. –</td>
<td>-0.03</td>
<td>0.50</td>
<td>-0.09</td>
<td>-0.06</td>
<td>-0.26</td>
<td>-0.78</td>
<td>0.12</td>
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<td>0.06</td>
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</tr>
<tr>
<td>SCECO-Central</td>
<td>(-3.79)*</td>
<td>(4.61)*</td>
<td>(-0.37)</td>
<td>(-0.08)</td>
<td>(-1.29)</td>
<td>(-1.01)**</td>
<td>(1.39)</td>
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<td></td>
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<tr>
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<td>-0.03</td>
<td>0.43</td>
<td>0.07</td>
<td>2.11</td>
<td>-0.17</td>
<td>-0.72</td>
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<td>0.06</td>
<td>(12.5)</td>
<td>0.40</td>
</tr>
<tr>
<td>SCECO-Western</td>
<td>(-3.73)*</td>
<td>(3.43)*</td>
<td>(0.26)</td>
<td>(2.41)**</td>
<td>(-0.76)</td>
<td>(-1.48)</td>
<td>(2.18)**</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Saudi Consol. Elec. Co. –</td>
<td>-0.02</td>
<td>0.51</td>
<td>0.06</td>
<td>0.01</td>
<td>-0.26</td>
<td>-0.57</td>
<td>0.11</td>
<td>0.23</td>
<td>0.05</td>
<td>(3.81)</td>
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</tr>
<tr>
<td>SCECO-Eastern</td>
<td>(-3.32)*</td>
<td>(4.78)*</td>
<td>(0.24)</td>
<td>(0.01)</td>
<td>(-1.32)</td>
<td>(-1.34)</td>
<td>(1.31)</td>
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</table>

Notes: see notes from Table 6.1.
6.4.7 Agriculture Sector Market Returns

The results from the agriculture sector are presented in Table 6.7. From the table we can extract the following conclusion. First, the likelihood ration test LR result presented in the table shows that the null hypothesis, that the coefficients of the five macroeconomic variables are simultaneously equal to zero, could not be rejected for all companies in the agriculture sector. This implies that the market premium seems to be the most important factor in explaining much of the variation in the companies' market returns. Secondly, the coefficient of the market premium $\beta_{f}$ is statistically significant and positive for all companies in the agriculture sector. The value of $\beta_{f}$ is less than one for all companies indicating that these companies are less risky than the average risk of the entire market. The only macroeconomic variable that has an effect on some company returns in the agriculture sector is the unexpected change of oil prices. Oil prices have a significant effect on the Al-Jouf Agricultural Development Company at a 5% level of significance and a National Agricultural Development at 10%.

Secondly, to test whether market risk is entirely captured by the market risk premium or not, we used the joint null hypothesis that the coefficient of the five macroeconomic variables is simultaneously equal to zero. The LR test shows that the null hypothesis is not rejected for all companies in the agriculture sector implying that market risk is entirely captured by the market risk premium.

Thirdly, examination of the result also shows that the size of company specific risk measured by $1-R^2$ is around 70% to 85% for all companies. This indicates that this
sector has very high unsystematic risk. The intercept term is statistically significant and negative for all companies in this sector, indicating that prices in this sector are over-priced.

<table>
<thead>
<tr>
<th>Company</th>
<th>$\alpha_i$</th>
<th>$\beta_{0i}$</th>
<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
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<th>$\rho$</th>
<th>$X^2_{sc}$</th>
<th>$L$</th>
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<tbody>
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<td>National Agriculture Development (NADEC)</td>
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<td>0.46</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.08</td>
<td>-0.39</td>
<td>0.09</td>
<td>0.34</td>
<td>0.04</td>
<td>(13.5)</td>
<td>(C)</td>
</tr>
<tr>
<td></td>
<td>(-7.37)*</td>
<td>(6.45)*</td>
<td>(0.03)</td>
<td>(0.02)</td>
<td>(-0.62)</td>
<td>(-1.38)</td>
<td>(1.74)**</td>
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<tr>
<td>Gassim Agriculture Co. (GACO)</td>
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<td>0.63</td>
<td>-0.19</td>
<td>0.18</td>
<td>0.00</td>
<td>-0.68</td>
<td>0.04</td>
<td>0.20</td>
<td>0.07</td>
<td>(20.1)**</td>
<td>(C)</td>
</tr>
<tr>
<td></td>
<td>(-3.77)*</td>
<td>(4.51)*</td>
<td>(-0.62)</td>
<td>(0.18)</td>
<td>(0.01)</td>
<td>(-1.24)</td>
<td>(0.37)</td>
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<td>0.10</td>
<td>-0.67</td>
<td>0.22</td>
<td>0.14</td>
<td>0.06</td>
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<td>(C)</td>
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<tr>
<td></td>
<td>(-6.54)*</td>
<td>(2.40)**</td>
<td>(-0.84)</td>
<td>(0.17)</td>
<td>(0.45)</td>
<td>(-1.38)</td>
<td>(2.36)**</td>
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<tr>
<td>Tabouk Agriculture Dev. (TADCO)</td>
<td>-0.04</td>
<td>0.51</td>
<td>-0.73</td>
<td>0.01</td>
<td>-0.38</td>
<td>-0.92</td>
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<td>0.05</td>
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<td>(C)</td>
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<tr>
<td></td>
<td>(-4.85)*</td>
<td>(4.85)*</td>
<td>(-0.97)</td>
<td>(0.061)</td>
<td>(-0.92)</td>
<td>(1.56)</td>
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<td>0.00</td>
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<td>-0.06</td>
<td>-0.15</td>
<td>-0.04</td>
<td>0.14</td>
<td>0.07</td>
<td>(19.5)**</td>
<td>(C)</td>
</tr>
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<td></td>
<td>(-4.37)*</td>
<td>(4.00)*</td>
<td>(0.01)</td>
<td>(-0.12)</td>
<td>(-0.20)</td>
<td>(-0.30)</td>
<td>(-0.39)</td>
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</tr>
<tr>
<td>Eastern Agriculture Dev.(SHADCO)</td>
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<td>0.70</td>
<td>-0.44</td>
<td>0.24</td>
<td>0.01</td>
<td>-1.06</td>
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<td>0.17</td>
<td>0.09</td>
<td>(14.3)</td>
<td>(C)</td>
</tr>
<tr>
<td></td>
<td>(-1.87)**</td>
<td>(3.82)*</td>
<td>(-1.07)</td>
<td>(0.18)</td>
<td>(0.43)</td>
<td>(-1.47)</td>
<td>(0.62)</td>
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<tr>
<td>Al Jouf Agriculture Dev. Co.</td>
<td>-0.03</td>
<td>0.44</td>
<td>0.10</td>
<td>-0.62</td>
<td>0.33</td>
<td>-0.54</td>
<td>0.34</td>
<td>0.13</td>
<td>0.10</td>
<td>(20.1)**</td>
<td>(C)</td>
</tr>
<tr>
<td></td>
<td>(-2.14)**</td>
<td>(2.32)**</td>
<td>(-0.46)</td>
<td>(0.96)</td>
<td>(-0.71)</td>
<td>(2.34)**</td>
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Notes: see notes from Table 6.1.
6.5 MARKET TIMING RISK

In the previous analysis we tried to measure the impact of unexpected change in macro-economic variables on company risk premium over and above the market premium. The result of the analysis shows that the unexpected change in narrow defined money supply had a significant impact on six companies. The unexpected change of inflation had an impact on three companies, the unexpected change of the exchange rate had an impact on seven companies, the unexpected change of the real interest rate had an impact on eight companies and the surprising oil prices had an impact on five companies. These results were not expected; especially the impact of oil prices.

As mentioned earlier, Saudi Arabia depends to a very large extent on oil, but the impact of oil tries on company premiums is not proportional to the share value of oil companies in the economy. One interpretation of this may be that this effect has been captured by the market premium included in our regression equation. In order to examine this assumption we replaced the market premium factor with a market timing risk factor. In the following manner:

\[ r_u - r_f = \alpha_i + \beta_{0,i} mtr + \beta_{1,i} urir_i + \beta_{2,i} urop_i + \beta_{3,i} uex_i + \beta_{4,i} uinf_i + \beta_{5,i} dlm_i + \epsilon_i \]  

(6.2)

where,

\[ mtr = \text{Market timing risk and its computed as that part of the market index total return that is not explained by the five macro-economic variables and an intercept term.} \]
The result of this equation is presented in the tables 6.8 to 6.14 in Appendix 6.1.

The results show that when substituting the market timing-risk factor with the market premium, the impact of macroeconomic variables becomes more explicit. The unexpected change in the exchange rate had a significant effect on all banks with the presence of market timing-risk factor comparing to three banks only in the presence of market premium. Moreover, the unexpected change of real oil prices had a significant and positive effect on eleven companies with the presence of market timing-risk factor comparing to four companies in the presence of market premium. This effect was mostly explicit in the electricity and agriculture sectors. These results prove our conclusion that the impact of oil is more significant in the subsidies sector and its effect on other companies is captured by the market risk premium.
6.6 CONCLUSION

In this chapter, we were concerned about identifying the determinants of the Saudi Stock market returns using the Arbitrage Pricing Model for both sectoral and firm level. The market return equation was estimated for six sectors and 45 companies listed on the Saudi stock market for the period from 1991:5 and 2000:5 using monthly time-series. Ordinary Least Square (OLS) was employed to estimate the result for six sectors and 45 companies. Our null hypothesis was used to test whether or not the coefficient of five macroeconomic variables was simultaneously equal to zero using the Likelihood Ratio Test (LR).

Our conclusion can be summarised as follows. First, the macroeconomic surprise variables seem to have had a different impact on various company risk premiums over and above the market premium. We employed the LR test to test the null hypothesis that the coefficients of the macroeconomic factors are jointly equal to zero. The test confirmed that the effectiveness of macroeconomic factors is true for two sectors/indexes and eight companies, half of which are in the service sector.

The second important finding of this work is that the company risk-free rate of return is substantially explained by the market risk factor and the coefficient of the market premium is statistically different from zero in almost all cases. To examine the effect of market premium on explaining company free return we replaced the market premium with a market timing-risk factor. The result proves our assumption that the impact of macro economic variables is captured by the market premium. From this we can conclude that the extension of the analysis of the risk-return relationship with the
multi-factor model adds little to our understanding of how the Saudi Stock Market works in the presence of market premium in the estimated return equation. In other words, one factor risk-return analysis carried out within the CAPM model seems affective for representing the risk-return relationship in the Saudi Stock Market. However, when we use the market timing-risk factor instead of the market premium, the impact of macroeconomic factors on asset-return becomes more explicit.

<table>
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<th>Sectors</th>
<th>$\alpha$</th>
<th>$\beta_0$</th>
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<th>$\beta_3$</th>
<th>$\beta_4$</th>
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<th>$\sigma$</th>
<th>$\chi^2_{sc}$</th>
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<td>-0.87</td>
<td>0.52</td>
<td>-0.52</td>
<td>0.07</td>
<td>0.89</td>
<td>0.02</td>
<td>(6.71)</td>
</tr>
<tr>
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<td>(-21.6)</td>
<td>(26.2)</td>
<td>(3.48)</td>
<td>(-2.84)</td>
<td>(6.53)</td>
<td>(-3.06)</td>
<td>(2.03)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Industrial Sector</td>
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<td>1.10</td>
<td>-0.14</td>
<td>0.24</td>
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<td>0.81</td>
<td>0.03</td>
<td>(15.1)</td>
</tr>
<tr>
<td>Index</td>
<td>(-18.0)</td>
<td>(20.1)</td>
<td>(-1.19)</td>
<td>(0.63)</td>
<td>(0.56)</td>
<td>(-1.89)</td>
<td>(2.29)</td>
<td></td>
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<td>Cement Sector</td>
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<td>0.81</td>
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</tr>
<tr>
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<tr>
<td>Services Sector</td>
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<td>0.04</td>
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<td>(-2.36)</td>
<td>(0.17)</td>
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<td>Electricity Sector</td>
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<td>-0.18</td>
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<td>0.05</td>
<td>(4.80)</td>
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<tr>
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<td>(-1.19)</td>
<td>(1.40)</td>
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<td>0.15</td>
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<tr>
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<td>(-2.61)</td>
<td>(0.76)</td>
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</tr>
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Notes: Coefficients refer to the following regression: $r_{it} - r_{ft} = \alpha + \beta_0 \text{mtr} + \beta_1 \text{um} + \beta_2 \text{Uinf} + \beta_3 \text{Uex} + \beta_4 \text{urir} + \beta_5 \text{urop}$, where parentheses are t-statistics. One (*) star shows that they are significant at the 1% level, two (**) indicate that they are significant at 5% level, and three (***) show that they are significant at 10% level. Variable definitions are provided in the text and their sources given in Chapter 4. $R^2$ is the coefficient of determination, $\sigma$ is the equation standard error. $\chi^2_{sc}$ (1) is the first order LM test of serial correlation, $\chi^2_3$ (1) is the test of functional form. Normality of errors and $\chi^2_H$ is the test of heteroscedasticity. LR is the LR test statistics carried out on the null hypothesis of $H_0$, where one (*) star shows that they are significant at the 1% level, two (**) indicate that they are significant at 5% level, and three (***) indicate that they are significant at 10% level.

<table>
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<th>$\beta_{1i}$</th>
<th>$\beta_{2i}$</th>
<th>$\beta_{3i}$</th>
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<th>$\sigma$</th>
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<td>(-0.75)</td>
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</tr>
<tr>
<td></td>
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<td>(0.932)</td>
<td>(-1.89)***</td>
<td>(2.59)**</td>
<td>(-2.73)*</td>
<td>(1.43)</td>
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<td>(-1.23)</td>
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<td>0.06</td>
<td>(20.8)***</td>
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<td>(-1.11)</td>
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<td>(0.95)</td>
<td>(2.43)**</td>
<td>(-0.573)</td>
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Notes: see notes from Table 6.8.

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<th>$\beta_{3i}$</th>
<th>$\beta_{4i}$</th>
<th>$\beta_{5i}$</th>
<th>$R^2$</th>
<th>$\sigma$</th>
<th>$X^2$</th>
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<td>(2.40)</td>
<td>(-0.78)</td>
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<td>(0.78)</td>
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<td>.51</td>
<td>.16</td>
<td>-.97</td>
<td>.13</td>
<td>-.62</td>
<td>.16</td>
<td>.25</td>
<td>.05</td>
<td>(12.6)</td>
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<td>(-11.7)</td>
<td>(4.85)</td>
<td>(0.70)</td>
<td>(-1.30)</td>
<td>(0.71)</td>
<td>(-1.51)</td>
<td>(2.05)</td>
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<td>.53</td>
<td>.03</td>
<td>-.36</td>
<td>.08</td>
<td>-.41</td>
<td>.00</td>
<td>.14</td>
<td>.07</td>
<td>(19.5)</td>
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<td>(-10.2)</td>
<td>(4.00)</td>
<td>(0.11)</td>
<td>(-0.38)</td>
<td>(0.34)</td>
<td>(-0.78)</td>
<td>(0.01)</td>
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<td>-0.06</td>
<td>.70</td>
<td>-.40</td>
<td>-.09</td>
<td>.18</td>
<td>-1.38</td>
<td>.14</td>
<td>.17</td>
<td>.09</td>
<td>(14.3)</td>
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<td>(-6.46)</td>
<td>(3.82)</td>
<td>(-0.98)</td>
<td>(-0.07)</td>
<td>(0.55)</td>
<td>(-1.94)</td>
<td>(1.00)</td>
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<td>Al Jouf Agriculture Dev. Co.</td>
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<td>.12</td>
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<td>.44</td>
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Notes: see notes from Table 6.8.
CHAPTER SEVEN
SUMMARY, CONCLUSION, AND RECOMMENDATION

7.1 INTRODUCTION

This chapter presents the summary of finding of the study along with its conclusions. The chapter also reveals some limitations of the study, and offers several recommendations for policy maker.

This study attempted to evaluate the performance of Saudi stock market through applied econometric analysis. The main purpose of the study is to investigate the determinant of returns on Saudi joint stock companies listed in the market. However, the study addressed three main issues:

1. The usefulness of the Capital Asset Price Model and the effect of the market premium in generating the companies return.
2. The impact of macroeconomic variables especially oil over and above the market.
3. The impact of macroeconomic variables in the absence of market premium and the presence of market timing risk.
7.2 SUMMARY OF FINDINGS

The first part of the study provided a preliminary background on the Saudi economy and stock market structure. The analysis of that part revealed that the Saudi economy has undergone a number of changes in its structure. The changes of economic structure were attributed to the development of Saudi stock market and changes in the nature of its function comparing to its function when first developed as a tool for distributing oil revenues to the public. This change in function played an effective role in transferring savings to long term investments. However, the market still suffers from low number of companies listed, concentration of shares in the hands of few share holders, and closure of the market to foreign investment.

We also provided in that part theoretical and empirical literature of CAPM and APT models. This was followed by a detailed discussion about macroeconomic risk factors in the empirical literature, in particular, inflation, interest rate, money supply, exchange rate, and oil prices.

The second part of the study examined the risk-return relationship in the Saudi stock market. The capital asset pricing model was applied and the result revealed. Firstly, the magnitude of systematic risk measured by betas showed variations within and across industries. On average, the beta for the banking sector was 1.20, 0.5 for electricity and agriculture, 0.88 for services, and 0.72 for cement and industrial firms. These figures imply that shares in the banking sector have higher risk over the market indicating that these shares are considered as aggressive stocks whereas the shares of other industries can be called defensive stocks. The disaggregated level results also showed that twenty-one companies out of forty-five have the same risk as the market.
index in which the null hypothesis of $\beta_i = 1$ could not be rejected. In addition, they showed that only four companies, mostly from the banking sector, have $\beta_i$ higher than one implying that the banking sector has the most aggressive stocks. These are: the Riyadh Bank, the Al-Jazira Bank, the Arab National Bank, and Al-Mawashi Company. The rest twenty-one companies have $\beta_i$ less than one and, therefore, can be called defensive stocks.

Secondly, by taking $R^2$ as a measure of the market portion of the total risk, the results show that the systematic risk accounts for 46% of the total risk in the banking sector. On the other hand, the systematic risks for the remaining industries are very low ranging between 25% and 11%. These figures imply that large variations in the company risk premium can be attributed to unsystematic risk since the portion of total risk, which is not explained by the market, is called unsystematic risk.

At the company level, the results showed that 7 companies had a risk of around 50% of the total risk in company-specific risk where six of them were from the banking sector. Another 7 companies had 65% company-specific risks while other 14 companies had 75% company-specific risk and were mostly from the cement sector or long-term investment shares. The rest of companies had 85% company-specific risk with higher involvement from the electricity and agriculture sectors, noting that both sectors are subsidised by the government.

Moreover, the null hypothesis, which assumes that the intercept is zero, was only rejected for 18 companies out of 45 companies implying the validity of CAPM in most cases. Those companies in which the null hypothesis was rejected are said to be
over-priced in accordance to the negativity of the constant term in most cases. These companies, which belong to the agricultural and electricity sectors, are inactive and depend on government subsidies. In this sense, it can be argued that the CAPM was largely acceptable in estimating risk-return relationships in the market. We should also add that the diagnostics related to the CAPM equations are, in general, acceptable.

The third part of the study examined the impact of five macroeconomic variables over and above the market premium. The macroeconomic surprise variables seemed to have had a different impact on various company risk premiums over and above the market premium. When carrying out the LR test to test the null hypothesis that the coefficients of the macroeconomic factors are jointly equal to zero, it confirmed that the effectiveness of macroeconomic factors is true for two sector indexes and eight companies, half of which are in the service sector.

Moreover, the company risk-free rate of return was substantially explained by the market risk factor and the coefficient of the market premium was statistically different from zero in almost all cases. We replaced the market premium with a market timing-risk factor in order to examine the effect of market premium on explaining company free return. The result proved our assumption that the impact of macroeconomic variables is captured by the market premium. Hence we concluded that the extension of the analysis of the risk-return relationship with the multi-factor model adds little to our understanding of how the Saudi Stock Market works in the presence of market premium in the estimated return equation. In other words, one factor risk-return analysis carried out within the CAPM model seemed affective for representing the risk-return relationship in the Saudi Stock Market. However when we used the market
timing-risk factor instead of the market premium, the impact of macroeconomic factors on asset-return became more explicit.
7.3 CONCLUDING REMARKS AND IMPLICATIONS

1. Market premium factor is the most important factor in determining company return in Saudi stock market. This implies that asset return is generated mainly by once factor and beta ($\beta_0$) is the most appropriate measure of systematic risk fro Saudi companies listed in the market in the study period.

2. The impact of unexpected change in macroeconomic variables is very limited over and above market premium. This indicates that the impact of these variables is accommodated on the market index.

3. Including the market timing risk in the APT model instead of market premium is better alternative to identify most important factors influencing various companies return.

4. The oil and interest rate is most important factor over and above market in theses companies that are having subsidies from the government such as agriculture and electricity while exchange rate is the most important factor in the banking sector.
7.4 RECOMMENDATIONS

Saudi stock market suffers from several problems: concentration, small number of listed companies, closed market and regulatory. The new market law issued in 2003 created a new security mission to control market activities in the following we will present some recommendations to improve effectiveness and efficiency of the market:

1. Increase the number of listed companies by revising conditions, procedure, guidelines and documents required for company formation and conversion to join stock company.

2. Increase the number of shares traded by offering shares owned by government to public and increase the capital of existed companies by offering shares to public based on the real values of the shares especially in the banking sector.

3. Open the market to foreign investment other than GCC nationals to help in capital formation and efficient pricing. This can be done gradually by putting restriction in the beginning then open market totally.

4. Revise the role of local banks in the stock market activities and resolve those that might have conflict of interest between commercial banks activities.

7.4.1 Limitation of the Study

The study looked only at the market portfolio, market timing risk and five macro economic factors as a source of systematic risk in the Saudi market. Some other factors, such as firm size, and price to equity ratio, were not considered.
However, the rest of the study is valid to the extent that the models of asset pricing are an adequate description of Saudi listed firms.

7.4.2 Future Research

There is a need for comparative study using data from both ESIS and Tadawul systems using both CAPM and APT to see the impact of system development on stock return explanatory power.
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