

**THE DETERMINANTS OF DELISTING RISK IN
THE EGYPTIAN INITIAL PUBLIC OFFERING
EQUITY MARKET**

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**THE DETERMINANTS OF DELISTING RISK IN THE
EGYPTIAN INITIAL PUBLIC OFFERING EQUITY
MARKET**

By

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ABSTRAK

Objektif utama tesis ini adalah untuk mengenalpasti penentu risiko penyahsenaraian (terdiri daripada kadar penyahsenaraian dan jangkamasa bertahan) bagi firma Tawaran Permulaan Awam yang disenaraikan di *Egyptian Exchange* dalam tempoh 1992-2009. Tesis ini terdiri daripada tiga objektif khusus. Dua objektif yang pertama adalah untuk mengenalpasti penentu kadar penyahsenaraian dan jangkamasa bertahan masing-masing. Objektif ketiga adalah untuk mengkaji pengaruh beberapa pembolehubah baru iaitu jenis firma, pemilikan institusional dan jenis penyenaian, keatas risiko penyahsenaraian. Model regresi logit dan probit digunakan dalam analisis penyahsenaraian sementara model regresi *Cox nonproportional hazards* digunakan dalam analisis jangkamasa bertahan. Kajian ini mendapati bahawa saiz firma, kecairan, kadar pertumbuhan aset, kadar perlindungan tunai, prestasi operasi, saiz terbitan, aktiviti IPO, pulangan awal, pemilikan institusional dan pemilikan dalaman mempunyai hubungan negatif serta signifikan dengan risiko penyahsenaraian sementara leveraj kewangan berhubungan secara positif dan signifikan. Tambahan pula, risiko penyahsenaraian didapati berkurangan secara signifikan bagi firma yang disenaraikan dalam *Official Schedule* dan firma yang disenaraikan sebelum Ogos 2002. Kajian ini mengesahkan peranan penting pembolehubah-pembolehubah berkaitan firma, isyarat, tawaran dan penyenaian dalam membezakan antara firma yang dinyahsenaraikan dan yang kekal disenaraikan melalui analisis statistik yang lebih kuat.

ABSTRACT

The main objective of this thesis is to identify the determinants of delisting risk (comprises delisting rate and survival time) of the IPO companies that are listed on the Egyptian Exchange over the 1992-2009 period. This thesis consists of three specific objectives. The first two objectives are to identify the determinants of delisting rate and survival time, respectively. The third objective is to analyze the influence of some new variables on delisting risk, namely firm type, institutional ownership, and listing variables. Logit and probit regression models are used in the delisting rate analysis, while Cox nonproportional hazards regression model is employed in the survival time analysis. It is found that firm size, liquidity, growth rate in assets, cash coverage, operating performance, offering size, IPO activity, initial return, institutional ownership, and insider ownership variables have significant negative relationships with delisting risk, while financial leverage has a significant positive influence on delisting risk. In addition, delisting risk is significantly lower in firms listed on the Official Schedule, and those listed before August 2002. This study thus confirms the significant role of firm, signaling, offering, and listing variables in discriminating delisted and survived firms through a more robust statistical analysis.

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LIST OF ABBREVIATION

AFT Model	=	Accelerated Failure Time Model
AMEX	=	American Stock Exchange
CASE	=	Cairo and Alexandria Stock Exchanges
CMA	=	Capital Market Authority
CPI	=	Consumer Price Index
EDR	=	Egyptian Depository Receipts
EBIT	=	Earnings Before Interest and Taxes
EGX	=	Egyptian Stock Exchange
EPS	=	Earnings Per Share
IFC	=	International Finance Corporation
IPO	=	Initial Public Offering
LPM	=	Linear Probability Model
MDA	=	Multiple Discriminant Analysis
MENA	=	Middle East and North Africa
NYSE	=	New York Stock Exchange
OLS	=	Ordinary Least Squares
PIPO	=	Privatization Initial Public Offering
RATS	=	Regression Analysis of Time Series
ROA	=	Return on Assets
ROC Curve	=	Receiver Operating Characteristic Curve
ROE	=	Return on Equity
ROS	=	Return on Sales
R&D	=	Research and Development
SEC	=	Securities and Exchange Commission
SEO	=	Seasoned Equity Offering
SOE	=	State-Owned Enterprise
SPSS	=	Statistical Package for the Social Sciences
VC	=	Venture Capital
VIF	=	Variance Inflation Factor

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The term "initial public offering" (IPO) of equity refers to a firm selling its common stock to the public for the first time. In other words, at the time of an IPO there is no existing public market for the stock (Reilly & Brown, 2006). Sometimes the IPO and "going public" terms are used interchangeably.

Many firms seek to go public because of the various benefits of IPO. IPO allows firms to improve financial condition, raise capital for the expansion of business operations, improve opportunities for future financing, increase market value of the firm, enhance corporate image, diversify current shareholder portfolios both domestically and internationally, increase employees' motivation, and to list on stock exchange. There are also some setbacks related to IPO. More specifically, IPO firms face losing control over information, sharing the firm's success with new investors, restricting management's actions and the actions of major shareholders, accountability, and paying initial and continuing expenses (Kleeburg, 2005).

This study focuses on the IPO event because it is one of the most significant events in a firm's history. There are structural modifications that should be done by managers before going public to guarantee the survivability of IPO firms such as the changes in strategy, personnel policies, and operating processes. If managers fail to adapt their firms with the new environment, firm's survival profile may deteriorate

(Jain & Kini, 2000; Khurshed, 2000). IPOs of common stocks are risky investments with high potential returns for investors (Miller, 1977). Most studies of IPOs performance focus on examining the initial returns (e.g., Ibbotson, 1975; Dewenter & Malatesta, 1997; Abdullah & Taufil-Mohd, 2004; Prasad, Vozikis, & Ariff, 2006; Farinós, García, & Ibáñez, 2007; Chambers & Dimson, 2009; Elston & Yang, 2010) and long-run returns (e.g., Ritter, 1991; Bhabra & Pettway, 2003; Kooli & Suret, 2004; Omran, 2005; Prasad et al., 2006; Ahmad-Zaluki, Campbell, & Goodacre, 2007; Cai, Liu, & Mase, 2008; Hsu & Chang, 2008; Yip, Ang, & Su, 2009; Chen, Chen, & Kao, 2010), ignoring the risks of IPOs.

Jenkinson and Ljungqvist (2001) provide a detailed review of IPOs concerning both short-run and long-run return studies. The studies on short-run returns report that offer prices are undervalued. This undervaluation of offer prices is called "underpricing anomaly". Reilly and Brown (2006) define anomaly as "*a security price relationship that appears to contradict a well regarded hypothesis; which is the efficient market hypothesis in this case*" (p. 1132). In addition, some studies of IPOs (e.g., Ritter, 1991; Kooli & Suret, 2004; Omran, 2005; Cai et al., 2008; Hsu & Chang, 2008; Yip et al., 2009) report that IPO returns perform poorly in the long-run. This phenomenon is known as "long-run underperformance anomaly".

The present study is interested in examining the risks of IPOs returns, instead of examining IPOs' returns. It is important to manage risk because return maximization is constrained by risk. That is, any business should focus on both return maximization and risk minimization to succeed (Chiou & Su, 2007). Risk can

be defined as the uncertainty of future outcomes or the probability of an unfavorable outcome (Reilly & Brown, 2006).

The risks of IPOs can be classified into two categories, namely the risk of short-run returns, and the risk of long-run returns. The risk of short-run returns refers to the uncertainty about the aftermarket price; known as "*ex ante* uncertainty" (Beatty & Ritter, 1986). The risk of IPOs in the long-run, on the other hand, refers to the involuntary delisting from the stock exchange due to negative reasons (Hensler, Rutherford, & Springer, 1997). This study focuses only on delisting risk in the IPO market.

After going public, firms may be acquired, merged, delisted, become private, become government owned, or stay survived. Delisting may be voluntarily or involuntarily. Voluntary delisting happens according to the desire of delisted firms. Involuntary delisting, however, is a compulsory delisting which usually happens due to financial distress of the delisted firm after the passage of a certain period of time; hence it can be considered as one indicator of the long-run performance of IPOs. In addition, Lamberto and Rath (2010) argue that survival is the ultimate assessment of the long-run performance because it tests firm's ability to survive in a competitive environment.

Based on Reilly's and Brown's (2006) definition of risk, which is the probability of an unfavorable outcome, delisting risk is defined in this study as the probability of involuntary delisting from the Egyptian Stock Exchange due to negative reasons. Delisting risk can be studied by examining either delisting rate or

survival time or both. Delisting rate refers to the likelihood of involuntary delisting occurrence in a particular period of time; usually three or five years (Li, Zhang, & Zhou, 2006), while survival time refers to time span from listing date to involuntary delisting date; known as listing period (Boubakri, Kooli, & L'Her, 2005; Li et al., 2006; Kooli & Meknassi, 2007; Jain & Kini, 2008; Goot, Giersbergen, & Botman, 2009).

The present study focuses only on the internal determinants of delisting risk because these determinants can be controlled by the firm. External determinants are associated with political and economic environments, which cannot be controlled by the firm (Chiou & Su, 2007). The IPO prospectus is the legal document which ensures that all important information is available to the prospective investors. Thus, the present study relies mainly on information available in the IPO prospectus to assess the importance of this information in determining the survival profile of IPO firms.

The remainder of this chapter is organized as follows: Section 1.2 presents problem statement, followed by Sections 1.3 which presents research objectives. In Section 1.4, scope of the study is examined. The significance and contribution of the study are explained in Section 1.5. Then, the structure of the thesis is presented in Section 1.6. This chapter ends with a conclusion in Section 1.7.

1.2 **PROBLEM STATEMENT**

The importance of ascertaining the determinants of delisting risk

Involuntary delisting event has adverse outcomes to both issuing firms and their existing shareholders. Issuing firms could no longer get financing through stock

market; which is a fast and cheap source of finance. In addition, delisted firms usually lose their good reputation after involuntary delisting. As such, delisting may trigger firms' creditors to call in their loans from the delisted firms, and it becomes more difficult for these firms to get the required finance from new creditors. Thus, credit ratings of these firms might be downgraded after delisting, which may increase their interest expenses and may cause bankruptcy accordingly. Furthermore, existing shareholder could no longer sell his shares in the stock exchange. He also finds difficulty to liquidate his investments under favorable conditions after delisting due to the excess supply of shares offered by the other existing shareholders. In addition, if the delisted firm is bankrupted or liquidated, the existing shareholders may lose their investments in the delisted firm. Therefore, identifying the determinants of involuntary delisting and the ability to predict its occurrence is crucial in order to control and reduce the number of involuntary delisted firms.

Study on IPO delisting allows the prediction of delisting based mainly on prospectus data. The determinants of IPO delisting may be different from those of bankruptcy and financial distress events, which are based on firm's profile for a pre-determined period before the event to predict the failure. IPO firms may have higher failure risk compared with more established firms, particularly within the early phase after going public (Jain & Kini, 2008; Lamberto & Rath, 2010). Jain and Kini (2008) find that approximately one in every three IPO firms either failing or being acquired during the first five years after going public in the U.S. In Australia, Lamberto and Rath (2010) also report that 20% and 29% of IPO firms fail during the first five and seven years, respectively, after the IPO date. This is because IPO firms are, on average, unknown, smaller, younger, and faced with high levels of uncertainty

regarding capital market conditions in comparison to more established firms (Jain & Kini, 2008). In addition, information asymmetry between issuers and investors is generally higher in IPO firms (Jain & Kini, 1999a; Jain & Martin Jr, 2005).

On the other hand, managers retain, on average, higher proportion of ownership in their IPO firms than those retained in seasoned equity offerings (SEOs) (Jain & Kini, 1999a). Based on the perspective of interest convergence theory of Jensen and Meckling (1976), high managerial ownership leads to diminishing agency costs owing to the alignment of interests between managers and owners (Jain & Kini, 2000). As a result, delisting risk may be less in IPO firms. In short, it is difficult to generalize the results of more established firms to IPO ones in the field of failure risk. Consequently, it is important to identify the determinants of delisting risk in the IPO market, especially with the scarcity and mixed evidence in delisting risk researches in that market.

The gap in past studies on IPO delisting risk

Prior studies on the determinants of IPO delisting risk are more recent than other studies on failure risk determinants. These determinants show mixed results in most cases. Taking initial return variable as an example, the relationship between initial return and delisting risk is significantly negative in the studies of Schultz et al. (1993), Hensler et al. (1997), Boubakri et al. (2005), and Demers and Joos (2007). However, it is significantly positive in the study of Kooli and Meknassi (2007), and insignificant in the studies of Bhabra and Pettway (2003), Yang and Sheu (2006), and Yung, Çolak and Wang (2008).

Additionally, some potential determinants of delisting risk are ignored by previous studies such as firm type, institutional ownership, listing schedule type, and listing rules variables. Firm type variable is found to be a significant determinant for IPO long-run returns in several studies (e.g., Menyah, Paudyal, & Inyangete, 1995; Durukan, 2002; Jelic & Briston, 2003; Huang & Song, 2005; Peter, 2007), with better performance in privatization IPOs compared with privately owned ones. Since high quality firms are characterized by high return and low delisting risk, privatized IPO firms are expected to have less delisting risk. This is because privatized IPO firms are larger, older, well known, and have more stable earnings compared with most privately-owned IPO firms. In addition, the two Egyptian IPO studies, namely Hegazy (2001) and Omran (2005) focus only on privatization IPOs. Thus, comparing the performance of privatization IPOs with privately owned ones is needed.

The relationship between institutional ownership variable and firm performance is justified by the three hypotheses introduced by Pound (1988), namely Efficient Monitoring, Conflict of Interest, and Strategic Alignment Hypotheses. Efficient Monitoring Hypothesis suggests that firm performance improves with the high participation of institutional investors due to their monitoring role over the managers' actions. Balatbat, Taylor and Walter (2004), among others, find support for this hypothesis in the Australian IPO market. Campbell, Hilscher and Szilagyi (2008) also report a significant negative relationship between institutional ownership and financial distress risk. Conflict of Interest and Strategic Alignment Hypotheses, however, argue that institutional investors find it is preferred to cooperate with firm's managers rather than to monitor their actions. Thus, it is not necessary to find superior performance in firms which have high institutional ownership. These two hypotheses are supported by Pound (1988). Additionally, Cai and Wei (1997),

among others, find insignificant relationship between institutional ownership and long-run IPO returns. Therefore, it is desirable to test these hypotheses based on IPO delisting risk data.

Listing type variable is studied by Ahmad-Zaluki et al. (2007), among others, as a potential determinant for long-run IPO returns. The Egyptian listing requirements on the Official Schedule are stricter than those on the unofficial one. Thus, delisting risk is expected to be higher in firms listed on the Unofficial Schedule, which usually include small, young, and unknown firms. In addition, new Egyptian listing rules are introduced on August 2002. These new rules are more stringent than the old ones. They have also permitted the involuntary delisting of bad firms. Therefore, higher delisting risk is expected in firms listed after imposing the new listing rules. Listing variables are extracted from the Egyptian context, and their relationships with delisting risk need to be tested. Consequently, a study that takes into account a comprehensive set of delisting risk determinants is desirable.

Furthermore, the studies related to IPO survival time (e.g., Hensler et al., 1997; Jain & Kini, 2000, 2008; Boubakri et al., 2005; Jain & Martin Jr, 2005; Yang & Sheu, 2006; Demers & Joos, 2007; Kooli & Meknassi, 2007; Yung et al., 2008; Lamberto & Rath, 2010) are less abundant and relatively new compared with the studies on IPO delisting rate.

Finally, very few studies utilize the binary probit model to examine the determinants of delisting rate (e.g., Willenborg & McKeown, 2001; Li et al., 2006). Probit model was less frequently used, compared with the logit model, due to the

long procedures used to estimate its parameters. However, it is very easy to estimate them now with the availability of related high-speed softwares (Brooks, 2008). Moreover, there is no study, to the best of my knowledge, employs Cox nonproportional hazards model to identify the determinants of survival time, in spite of its appropriateness in fitting the data for such study. Prior related studies use Cox proportional hazards model without testing the proportionality test. As such, these studies may suffer from choosing the wrong Cox regression model. Therefore, there is a need to utilize binary logit, binary probit, and Cox nonproportional hazards models to ensure robustness in the methods used to examine the determinants of delisting risk in order to deliver more reliable findings.

The need to study the Egyptian IPO delisting risk

Delisting event is one of the most important issues now in the Egyptian Stock Exchange (EGX). This is due to the accelerating number of delisted firms from the EGX during the last years. More specifically, the number of delisted firms from January 2002 to November 2003 is 115 firms; 85 firms are delisted involuntarily and 30 firms are delisted voluntarily. In addition, the number of delisted firms from the EGX over the 2004-2009 period is 657 firms; 107 firms in 2004, 76 firms in 2005, 166 firms in 2006, 161 firms in 2007, 82 firms in 2008, and 65 firms in 2009.¹ Consequently, the number of listed firms decreased from 1151 in 2002 to 306 firms in 2009 as illustrated in Table 1.1. It is evident from the previous statistics that the

¹ These statistics of listing and delisting are obtained from:

- CMA monthly bulletin, various issues.
- The EGX monthly bulletin, various issues.
- Al Qabas Journal, no. 12562, 12/5/2008.
- Alboursa Almisria, no. 1830, 2/2/2004.

number of delisted firms has a declining trend after the year of 2006. These statistics are related to both the publicly and closely traded firms.

With regard to the statistics of IPOs, the number of firms that offered IPOs within the period 1992-2009 is 352 IPO firms. In addition, the number of IPO firms after excluding financial firms and merger & acquisition firms is 293 IPO firms (the population). 76 (26%) and 30 (10%) IPO firms are delisted involuntarily and voluntarily, respectively, from this population. These statistics are detailed in Chapter 4 in data collection process.

Table 1.1 Number of listed and traded firms and market capitalization in the EGX over the period of 1992-2009

Year	No. of Listed Firms	No. of Traded Firms	Market Capitalization (Billion Egyptian Pounds)	Year	No. of Listed Firms	No. of Traded Firms	Market Capitalization (Billion Egyptian Pounds)
1992	656	239	11	2001	1110	643	112
1993	674	264	13	2002	1151	671	122
1994	700	300	15	2003	978	540	172
1995	746	352	27	2004	795	503	234
1996	646	354	48	2005	744	441	456
1997	650	416	71	2006	595	407	534
1998	870	551	82	2007	435	337	768
1999	1033	663	112	2008	373	322	474
2000	1076	659	121	2009	306	289	500

Sources: 1- CMA annual report, various issues.
2- EGX web site (www.egyptse.com).

Table 1.1 indicates that the number of the Egyptian listed and traded firms has an upward trend from the year of 1992 to its peak in the year of 2002. However, this upward trend has been reversed to a downward trend after the year of 2002 until now. The decline in the number of the Egyptian listed firms is attributed to the delisting of firms either voluntarily or involuntarily. Hence, study on involuntary delisting in Egypt and its determinants are desirable to protect firms and investors from its bad effects.

Despite the growing number of delisted firms in Egypt, either involuntarily or voluntarily, little is known on the determinants of IPOs delisting in Egypt. Studies related to IPOs in Egypt are scarce; particularly the studies on delisting risk. The review of published literature shows that there are only two studies on IPOs in Egypt, namely Hegazy (2001), and Omran (2005). Both studies focus on investigating the returns of IPOs.

Moreover, most previous studies which examine delisting risk are executed in the U.S. Unlike the U.S market, which is a developed market, Egypt is an emerging market. Given the differences in the legal, institutional, and listing requirements between the developed and emerging markets, factors that affect delisting risk of IPOs in Egypt, as an emerging market, may be different from those in the advanced markets like the U.S. For instance, using the number of uses of IPO proceeds and the number of risk factors, as disclosure variables, is not relevant in Egypt, although they are important to be studied in the U.S because these two variables are related to the U.S regulation of the Securities Act in 1933 (Beatty & Ritter, 1986; Beatty & Welch, 1996)². In addition, the Egyptian new listing rules variable is derived from the Egyptian context. So, it is relevant to study this variable only in Egypt and in other countries that have similar regulations. Moreover, unlike the U.S, the numerical earnings' forecast is not mandatory in the IPO prospectus in Egypt. Therefore, there is a crucial need for a comprehensive study on involuntary delisting in Egypt.

² In the U.S, Section 11 of the Securities Act in the year of 1933 requires more speculative issuers to provide relatively detailed subscription of the uses of proceeds and the risk factors, while more established issuers are not required to do that (Beatty and Ritter, 1986; Beatty and Welch, 1996).

1.3 RESEARCH OBJECTIVES

- **The General objective:**

The main objective of this study is to examine the determinants of delisting risk in the Egyptian IPO equity market.

- **The specific objectives:**

Delisting risk can be measured by using delisting rate and survival time (Li et al., 2006). Therefore, the previous general objective is translated into the following three specific objectives:

- 1- To ascertain the determinants of IPO delisting rate in the Egyptian Stock Exchange.
- 2- To examine the determinants of survival time of IPO firms listed on the Egyptian Stock Exchange.
- 3- To analyze the influence of some new variables, namely firm type, institutional ownership, listing rules, and listing schedule on IPO delisting risk.

1.4 SCOPE OF THE STUDY

The studies of IPOs returns and those of short-run risk of IPOs have been studied well by many researchers, as mentioned earlier. However, the studies of long-run risks of IPOs are less abundant. Thus, this study focuses only on examining delisting risk in the IPO equity market; which is a long-run risk. In addition, this

study focuses only on the involuntary delisting to show the determinants of delisting resulting from negative reasons. As such, the firm should identify involuntary delisting determinants to avoid it and its costs. Furthermore, this study employs data from the Egyptian stock market over the period of 1992-2009. The year of 1992 is chosen as a starting year because the Egyptian Capital Market Law Number 95 is issued in that year. This law is the main factor of the re-emergence of the Egyptian capital market. Meanwhile, December 2009 is chosen as an ending point because data were available to the researcher until that date.

Egypt is chosen in this study because the studies about IPOs in Egypt are scarce. Further, market capitalization is growing in the EGX despite the decreasing number of listed and traded firms, and the increasing number of delisted firms. Specifically, Table 1.1 shows an upward trend in market capitalization until its peak in 2007. The value of market capitalization in that year was 768 billion Egyptian pounds (equivalent to 139 billion U.S dollars)³. In the year of 2008, market capitalization declined to 474 billion Egyptian pounds (equivalent to 86 billion U.S dollars) due to the global financial crisis. However, it rose again in the year of 2009 to 500 billion Egyptian pounds (equivalent to 90 billion U.S dollars). Besides, the number of delisted firms in Egypt is high; as detailed earlier. Nearly 30% of IPO firms are delisted involuntarily in the first five years after going public based on the sample used in this study.

Moreover, the Egyptian stock market is an attractive market to study. It has relative advantages when compared with other emerging financial markets,

³ The yearly exchange rate from the US dollar to the Egyptian pound over the period of 1992-2009 is shown in Appendix 1.

especially in the Middle East and North Africa (MENA) region. Specifically, it is the oldest market in the MENA region, one of the most open and advanced financial markets in the region, no taxes imposed on dividends or capital gains, no restrictions on foreign investments, no restrictions on the repatriation of capital gains and dividends, active foreign involvement, significant retail and institutional participation, low listing and trading fees, high dividend yield and P/E ratio, local presence of international investment banks, and it includes well diversified sectors and firms. Consequently, Egypt is included in many international indices (such as International Finance Corporation (IFC) and Morgan Stanley Indices) (Azab, 2002; Brokers, 2006).

1.5 THE SIGNIFICANCE AND CONTRIBUTION OF THE STUDY

1.5.1 Contribution to the Theory

The present study adds to the existing literature on IPO delisting risk. Specifically, the determinants of delisting risk are examined in the IPO market. As mentioned earlier, the studies concerning delisting risk offer mixed results and are concentrated in the U.S. Considering the differences between the Egyptian and the U.S markets, examining the risks in the Egyptian IPO equity market allows for further testing of existing theories for emerging IPO markets. In addition, many potential determinants of delisting risk (e.g., firm type, institutional ownership, listing rules, and listing schedules) are ignored in prior studies. Thus, this study fills the gap in that field. Moreover, there is lack of empirical evidence in regard to the determinants of IPO delisting risk in Egypt.

Many theories have been used to explain long-run underperformance of IPOs. The related theories used in this study are agency cost hypotheses of Jensen and Meckling (1976), and Morck, Shleifer and Vishny (1988), signaling hypotheses of Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989), the window of opportunity hypothesis of Ritter (1984, 1991) and Loughran and Ritter (1995), Certification hypothesis of Carter and Manaster (1990), marketing event hypothesis of Chemmanur (1993) and Demers and Lewellen (2003), divergence of opinion hypothesis of Miller (1977), speculative bubble hypothesis of Ritter (1984), overreaction hypothesis of De Bondt and Thaler (1985, 1987), fads hypothesis of Aggarwal and Rivoli (1990), and stabilization hypothesis of Ruud (1993).

Although the previously mentioned hypotheses developed to explain long-run underperformance anomaly, they can also be used to explain delisting risk. Thus, this study enhances the understanding and application of IPOs long-run theories on delisting risk. In addition, there are additional related theories are tested such as the resource-based theory, efficient monitoring hypothesis, conflict of interest and strategic alignment hypotheses, and the trade-off theory of capital structure.

1.5.2 Contribution to Research Methods

The definition of survival time employed in this study takes into account the enforcement date of the new Egyptian listing rules issued on August 2002. This adjusted survival time definition is more suitable for the Egyptian environment. It defines survival time as the difference between the involuntary delisting date and either the listing or enforcement date, whichever comes later. The raw survival time,

which is the listing period, is also employed in the survival time analysis to check the robustness of results.

Furthermore, the binary probit and Cox nonproportional hazards models are employed in the present study to analyze delisting risk. To the best of my knowledge, this is the first study that utilizes Cox nonproportional hazards model to examine survival time despite its appropriateness to model the dataset, and hence a more reliable result is obtained on the determinants of delisting risk. In addition, very few studies employ probit model to analyze delisting rate (e.g., Willenborg & McKeown, 2001; Li et al., 2006).

1.5.3 The Practical Contribution

Involuntary delisting is not preferred to both issuers and investors due to its high costs. Therefore, studying the determinants of delisting risk can guide investors to invest in firms with low expected delisting risk based mainly on information available in the IPO prospectus. It can also inform issuers whether it is viable to offer their IPOs now or later, in addition to providing them with the factors responsible for ameliorating their survival profile in the IPO market. Furthermore, managers of IPO firms are interested in the survival of their firms to maintain their reputation and financial interests in their firms. Finally, listing and delisting rules setters can benefit from the findings of this study to set reliable listing and delisting rules.

1.6 STRUCTURE OF THE THESIS

This thesis consists of six chapters. Chapter one is an introduction to the study. It contains a background, problem statement, research objectives, scope of the study, significance and contribution of the study, structure of the thesis, and conclusion. Chapter two presents information about the Egyptian Stock Exchange and IPO market. Literature review is presented in chapter three. This chapter begins with related theories of IPO long-run performance, and other related theories. Then, related empirical studies on delisting risk of IPO returns are discussed. It ends with a conclusion in the last part of the chapter.

Research methods are presented in chapter four. This chapter includes theoretical framework, variables and hypotheses of the study, the measurement of variables, the models used in the study, data collection process, and a summary which summarizes the previous elements. Chapter five includes data analyses used to obtain research findings based on logit, probit and Cox regression models. Chapter six presents an overall view of the study, discusses research findings, and presents related recommendations. It also presents the limitations and implications of the study.

1.7 CONCLUSION

This study is motivated by the adverse outcomes of involuntary delisting on both issuing firms and their existing shareholders, the weaknesses of past studies on IPO delisting risk, and the need to study the Egyptian IPO delisting. To detail, involuntary delisting may lead to bankruptcy, which results in the end of the issuing

firm and the probability of losing existing shareholders invested capital in the delisted firm. In addition, prior related studies on the determinants of IPO delisting risk show mixed results in most cases. They also ignore some variables that are hypothesized to be significant on delisting risk such as firm type, institutional ownership, listing rules, and listing schedule, in addition to ignoring the probit and Cox nonproportional hazards models despite their relevance to fit the data of such study.

Moreover, there is a special need to identify the determinants of IPO delisting risk in Egypt due to the large number of involuntary delisting cases and the lack of related empirical evidence on the Egyptian IPO market. Therefore, the main objective of this study is to identify the determinants of delisting risk in the Egyptian IPO equity market over the period of 1992-2009, after considering the previously mentioned new variables ignored in the prior related studies. Both delisting rate and survival time analyses are employed to achieve this objective. In addition, several theories are employed to justify these determinants.

After discussing problem statement, research objectives, scope of the study, contribution of the study, and structure of the study in this chapter, it is important to present some information about the Egyptian Stock Exchange and IPO market. The following chapter is dedicated to achieve that goal.

CHAPTER 2

THE EGYPTIAN STOCK EXCHANGE AND IPO MARKET

2.1 INTRODUCTION

The Egyptian Stock Exchange (EGX) is the only registered securities exchange in Egypt. It is a governmental entity directed by the Capital Market Authority (CMA) (Omran & Girard, 2007). CMA is the governmental agency responsible for regulating the Egyptian security market. The CMA's primary duties are to protect investors and to support the development of efficient, orderly, and well-regulated primary and secondary markets for securities. Although the CMA was established in 1979 by the Presidential Decree No. 520, it did not take on its full importance until the 1990s.

This chapter begins with the history of the EGX in Section 2.2 followed by Section 2.3, which discusses the Egyptian privatization program. After these two sections, a description of the regulatory framework that governs the Egyptian stock market operations is discussed in Section 2.4. Sections 2.5 and 2.6 present the Egyptian market indices, and the mechanism formed to protect small and outside shareholders, respectively. Some information about IPO, listing, and involuntary delisting in the Egyptian market is discussed in Section 2.7. This chapter ends with a summary in Section 2.8.

2.2 THE HISTORY OF THE EGYPTIAN STOCK EXCHANGE

The EGX, formerly known as the Cairo and Alexandria Stock Exchanges (CASE), is one of the oldest stock exchanges in the world and includes two exchanges, namely Alexandria Stock Exchange and Cairo Stock Exchange established in 1883 and 1903, respectively. Although the two exchanges were competing with each other since their formation, they were integrated recently. They are directed by the same board of directors, and they share the same trading, clearing and settlement systems. So that the market participants have access to stocks listed on both exchanges (Mecagni & Sourial, 1999; the EGX web site⁴).

The EGX was very active in the 1940s and it was the fifth most active stock exchange in the world during that period. However, the central planning and the socialist policies adopted by the government led to a major nationalization program that started in 1959. Consequently, the stock market remained dormant for the following 20 years (Abdel Shahid, 2001; Azab, 2002; Bolbol, Fatheldin, & Omran, 2005).

The adoption of the “open door” policy in 1974 resulted in the creation of the Egyptian CMA in order to manage the stock market. Nevertheless, due to several reasons (e.g., biases in the tax code against investment in securities, unavailability of a governing securities’ law, lack of financial disclosure, lack of protection of small investors, and the unfavorable economic environment) the EGX remained inactive until the early years of 1990s (Bolbol et al., 2005).

⁴ The EGX website is: www.egyptse.com.

The issuance of the Privatization Law No. 203/1991 and the Capital Market Law No. 95/1992 resulted in the reactivation of the capital market through supporting private investment and increasing investors' protection (Azab, 2002; Bolbol et al., 2005). In addition, the EGX was ranked seventh for number of listed firms, twenty-third for trading value, and twentieth for turnover ratio in 1997 relative to the 32 emerging markets included in the IFC Global Index (Mecagni & Sourial, 1999).

Despite reaching top valuations in February 1997, the situation was reversed in the second half of year 1997. Moreover, in the year of 1998, the activity was moving slowly with a continuous weakness in the bulk of the most actively traded shares. This deterioration in performance is attributed to both external and internal factors. The main external factors include the South East Asian crisis in July 1997 and the significant fall in oil prices in November 1997. However, the principal domestic factors are Luxur attack⁵ in November 1997 and the foreign exchange crisis at the end of year 1997 (Bolbol et al., 2005; Mecagni & Sourial, 1999, 2002).⁶

The year of 2000 witnessed the establishment of the disclosure department in the EGX to monitor disclosure practices (Abdel Shahid, 2003). The EGX 30 index recorded an upward trend in the EGX during the years of 2004 and 2005. In addition, high increase in the volume and value of trading occurred in these two years (Stock Market Annual Report, 2004 and 2005). Most Arab markets are adversely affected

⁵ Luxur is a city in the Upper Egypt. It is one of the most famous touristic cities in the world. It subjected to a terroristic attack on 17 November 1997. This event caused terror among tourists, which resulted in a significant decrease in the revenues of the tourism sector.

⁶ South East Asian crisis encouraged Egyptian investors to import more goods from South East Asia's countries. Therefore, the demand for the U.S dollars increased; which was the main reason for the foreign exchange crisis in Egypt.

by the three major shocks in the year of 2006, namely the Gulf markets' crash, Lebanon war, and raising interest rate by the US Federal Reserves. However, the Egyptian stock market was able to resist these shocks due to the economic reform and structural development, continuous marketing efforts, applying flexible fiscal policies, and the active implementation of the privatization program (Stock Market Annual Report, 2006).

The EGX suffered from the global financial crisis in the year of 2008. The value of the EGX 30 index declined from 10549.74 points at the end of year 2007 to 4596.49 points at the end of year 2008. However, the year of 2009 witnessed an upward trend in the EGX indices. For example, the value of the EGX 30 increased by 35% compared with the situation at the end of year 2008 (Stock market annual report, 2008 and 2009). In June 2008, the name of the Egyptian exchange changed from Cairo and Alexandria Stock Exchanges (CASE) to the Egyptian Stock Exchange (EGX). In addition, The Egyptian Depository Receipts (EDRs) are created in October 2008 to facilitate the listing of regional and other foreign issuers (The Egyptian Exchange Year Book, 2008).

Remarkable foreign participation in the EGX is reported. This participation is attributed to the diversity of investment opportunities resulting from the increase in the successful listings on the stock exchange and the sales of stakes in major utility firms (Brokers, 2006). In addition, dividends and capital gains are not taxable, and there are neither regulatory limitations preventing foreign participation in the market nor any prohibitions against repatriation of profits (Abdel Shahid, 2003; Omran & Girard, 2007).

2.3 THE EGYPTIAN PRIVATIZATION PROGRAM

Public Enterprise Law No. 203 for the year of 1991; known as the Privatization Law, and the Capital Market Law No. 95 for the year of 1992 represent the base for the Egyptian privatization program. In law 203/1991, the government determined 314 public sector enterprises under 27 holding firms as possible candidates for the privatization process (Abdel Shahid, 2003).

The sales proceeds raised from the IPO method are 17067 million Egyptian Pounds. It represents the second source of sales proceeds after the proceeds raised by anchor investors' method (32208 million Egyptian Pounds). The percentage of IPO proceeds are equivalent to 32% of the total sales proceeds collected from the Egyptian privatization program based on the statistics of August 2009. In addition, IPO method has the second largest number of privatized firms after the anchor investor method. Specifically, 61 firms are privatized through IPO method; which represent 22% of the total privatized firms according to the statistics of August 2009. Although the first use of the IPO method in the Egyptian privatization program was in 1994 through minority offering method, the year of 1995 witnessed the first privatization process through majority IPO method. In addition, the largest number of privatized firms (20 firms) using the IPO method occurred during the year of 1996 (Ministry of Trade and Industry, monthly economic bulletin, March 2005; EGX monthly bulletin, August 2009).

2.4 REGULATORY FRAMEWORK

The EGX is currently having several legislations that regulate firms within the market. The main laws that govern the Egyptian stock market operations are:

- **The Corporate Law (Law 159/1981)**

This law sets the framework for setting up and operating of the joint stock firms, partnership limited by shares firms and limited liability firms (Abdel Shahid, 2001; The Egyptian Exchange Year Book, 2008).

- **The Privatization Law (Law 203/1991)**

This law is the essential legislation for the development of the privatization program. The main purpose of this law is to transfer the government-owned firms into privately-owned ones. This law identified 314 public sector firms for sale to the public. Once 51% or more of any public sector firm is privatized, the firm automatically moves to law 159/1981 (Abdel Shahid, 2001; Azab, 2002).

- **The Capital Market Law No. 95/1992⁷**

The Capital Market Law came into effect in 1992. This law regulates the EGX. In addition, it regulates the establishment and operations of securities' intermediary firms. One of the main benefits of this law is the recognition of the vital role of the CMA in organizing and controlling the market (Abdel Shahid, 2001; The Egyptian Exchange Year Book, 2008).

⁷ The Capital Market Law and its Executive Regulations are available at the CMA website (www.cma.gov.eg).

- **The Investment Law (Law 8/1997)**

This law promotes investment in specific economic sectors and new industrial locations (The Egyptian Exchange Year Book, 2008).

- **The Central Depository Law (Law 93/2000)**

This law regulates the shareholders record keeping, clearing and settlement (The Egyptian Exchange Year Book, 2008).

- **The Capital Market Law No. 123/2008**

This law amended certain provisions of the Capital Market Law No. 95/1992. Specifically, it increased the flexibility of procedures and tightened the penalties related to securities crimes (The Egyptian Exchange Year Book, 2008).

2.5 THE EGYPTIAN MARKET INDICES

- **The Capital Market Authority Index (CMAI)**

This index started on the second of January 1992 with a base value of 100 points. It is known as the General Egyptian Index because it includes all listed shares weighted based on their market capitalization. As a result, it can be regarded as a benchmark for all shares listed on the EGX (Azab, 2002; Mecagni & Sourial, 1999). The General Egyptian Index contains both the Public Egyptian Index; which only includes the publicly traded firms, and the Closed Egyptian Index; which only contains the closely traded firms.

- **The EGX 30 Index**

The EGX started publishing this index on the second of February 2003. However, it was retroactively computed as of the first of January 1998 (the base date) with a base value equivalent to 1000 points. This index contains the top thirty firms in terms of liquidity and activity (the EGX website: www.egyptse.com).

- **Dow Jones Egypt Titans 20 Index**

This index is introduced on April 2006. However, the base date is on December 31, 2001 with a base value of 100 points. It consists of the top 20 firms in terms of float-adjusted market capitalization (The Egyptian Exchange Year Book, 2008; the EGX website: www.egyptse.com).

- **S&P/EGX ESG Index**

The base date of this index is June 28, 2007, with base value equivalent to 1000 points. It includes the top 30 firms that have the highest score in terms of environmental, social and corporate governing factors (the EGX website: www.egyptse.com).

- **Sector Indices**

The sector indices were issued in Egypt on the fourth of September 2007. They contain several indices tracking the main sectors of the Egyptian market, namely Banks, Basic Resources, Chemicals, Construction and Materials, Food and Beverage, Financial Services excluding Banks, Healthcare and Pharmaceuticals,

Industrial Goods, Services and Automobiles, Personal and Household Products, Real Estate, Telecommunications, and Travel and Leisure (the EGX website: www.egyptse.com).

- **The EGX 70 Index**

This index started on the first of March 2009 to track the performance of the most active 70 firms, after excluding the 30 firms included in the EGX 30 Index. However, the base date is 1 January 2008 with base value equals 1000 points (the EGX website: www.egyptse.com).

- **The EGX 100 Index**

Although this index is introduced on the second of August 2009, the base date is the first of January 2006, with 1000 points base value. It tracks the performance of the most active 100 firms, including both the 30 firms of the EGX 30 Index and the 70 firms of the EGX 70 Index (the EGX website: www.egyptse.com).

2.6 MECHANISMS FORMED TO PROTECT SMALL AND OUTSIDE SHAREHOLDERS IN THE EGX

Many mechanisms are formed to protect small and outside shareholders in the EGX. First, insider trading rules mandate firm's directors and senior managers to disclose their trading on the firm's securities to the disclosure department prior to their implementation. This procedure is similar to the situation in the U.S. They are also prohibited from trading in case of financial information and material event releases for a period of 15 days before the press release and three days after it (Blowers, Erickson, & Milan, 1995; Abdel Shahid, 2005). Second, there is a whole

chapter in the Capital Market Law No. 95/1992 called “penalties”⁸. According to this chapter, anyone publishes information to deceive investors will bear a penalty of fines, imprisonment, or both. These penalties are existed in many countries. Law 123/2008 tightened these penalties compared with the situation in law 95/ 1992 (The Egyptian Exchange Year Book, 2008).

Finally, it is not allowed to the firm’s founders to sell stocks in their firms during the first two years. This prohibition is extended to any increase in the firm’s capital⁹. Thus, the lock-up period in Egypt is different from that in other countries.¹⁰ In the U.S market, the lock-up period is for a shorter period of time (six months). However, it ranges from six months to about three years in the UK (Ahmad-Zaluki, 2005). In Malaysia, the majority shareholders are not allowed to sell their shares for one-year after the listing period. Then, they can sell up to one-third of their shares every year (Taufil-Mohd, 2004).

2.7 IPO, LISTING, AND INVOLUNTARY DELISTING IN THE EGX

2.7.1 An Overview of IPO in the EGX

Article 40e¹¹ of Law 95/1992 mandates firms before issuing the offer of securities to the public to file a prospectus approved by the CMA. It should also be clearly indicated in the prospectus that the CMA’s approval neither guarantee the commercial quality of the business nor the project’s ability to achieve specified

⁸ Penalties are presented in Chapter 6 of the Capital Market Law No. 95/1992.

⁹ See Alboursa Almisria, year 126, number 1872, Monday 22/11/2004.

¹⁰ "Lock-up" refers to banning insiders from selling their shares for a period of time (Ahmad-Zaluki, 2005).

¹¹ The letter “e” is used as an abbreviation of “the Executive Regulations of the Capital Market Law No. 95 for the year 1992”.

results. Article 5 of Law 95/1992 shows that the prospectus of a firm at incorporation should disclose its purpose and duration, issued and paid up capital, characteristics of the shares being offered and the terms of offer, names of the founders and the capital subscribed by each and the payment in kind, if any, the firm's plan for the use of proceeds of sale and its expected results, places where the certified prospectus could be obtained, and any other information as defined by the Executive Regulations in Article 42e.

Other types of prospectus should, in addition to the information stipulated in the preceding paragraph, disclose the business history of the firm, names of the board members, directors and responsible officers and their experiences, name and ownership percentage of each shareholder of nominal shares who owns more than 5% of the firm's shares, and audited financial statements of the last three years, or for the period from the date of firm incorporation whichever is less.

Article 48e of law 95/1992 mentioned that the subscription period should not be less than ten days and not more than two months. In addition, if the offered shares are not fully subscribed within this period, the chairman of the CMA may extend the subscription period for not more than two additional months. Article 101e of law 95/1992 mandated that the EGX should provide the CMA with the required information about listed firms within one week of the approval to list shares.

2.7.2 Listing Requirements

Firms can be listed on either the Official Schedule or on the Unofficial Schedule. The requirements of listing on the Official Schedule are stricter than those

required for listing on the unofficial one (Azab, 2002). According to Article 16 of law 95/1992, Official Schedule is dedicated to the securities issued by the government and offered to the public, in addition to shares and other securities of the public sector firms. It also contains shares, bonds, financial notes, and other securities offered to the public by joint stock and by limited partnership firms, provided that they meet two conditions. First, the nominal shares offered to the public should not be less than 30% of the total firm shares. Secondly, the number of subscribers should not be less than 150.

When the number of shareholders declines below 100 for more than three consecutive or separated months during the fiscal year of the firm, the shares should be transferred to the Unofficial Schedule of the stock exchange. The Unofficial Schedule, on the other hand, is dedicated to list foreign securities (in Unofficial Schedule 1) as well as shares and other securities that do not meet with the listing conditions of the Official Schedule (in Unofficial Schedule 2). Table 2.1 shows listing rules before the first of August 2002.

Table 2.1 Listing rules before August 1, 2002

Requirements	Official	Unofficial(1)	Unofficial(2)
Minimum number of shareholders	150	-	-
Minimum nominal number of shares as a percentage of the total company shares	30%	-	-
Shareholders' equity	Not less than company's paid up capital	Not less than company's paid up capital	Not less than company's paid up capital
Minimum years of operation	3 years	2 years	1 year

Source: Listing and Disclosure Department, EGX.

The EGX listing rules were updated and implemented on August 2002 for firms listed on or after that date. In addition, these new rules were implemented in practice on September 2003 after a one-year grace period for firms listed before

August 2002. The new listing rules are stricter than those required in old ones. These new rules shift larger firms towards the Official Schedule, and smaller firms towards the Unofficial Schedule.

The new listing rules are illustrated in Table 2.2. They segment the Official Schedule into two schedules. Official Schedule (1) is devoted to listing the securities of joint stock and limited partnership firms provided that they meet the condition illustrated in Table 2.2. However, Official Schedule (2) is dedicated to listing the securities issued by the government and the public sector firms. Three criteria were added to the new listing rules, namely minimum ratio of net profit before taxes to issued capital, minimum issued and paid up capital, and minimum number of issued shares (Berg & Mierta, 2004).

Table 2.2 Listing rules from August 2002 to October 2008

Requirements	Official (1)	Official (2)	Unofficial(1)	Unofficial(2)
Minimum number of shareholders	150	-	50	-
Minimum nominal number of shares as a percentage of the total company shares	30%	-	10%	-
Minimum issued and paid up capital	LE 20 million	LE 20 million	LE 10 million	LE 5 million
Minimum number of issued shares	2 million	2 million	1 million	0.5 million
Minimum net profit before taxes as a percentage of issued capital	5%	5%	5%	1%
Shareholders' equity	Not less than total issued and paid up capital	Not less than total issued and paid up capital	Not less than total issued and paid up capital	Not less than company's paid up capital
Minimum years of operation	3 years	-	2 years	1 year

Source: Listing and Disclosure Department, EGX.

Table 2.3 The new listing rules issued on October 2008 based on the law no. 123 of year 2008

Requirements	Egyptian securities	Foreign securities
Minimum number of shareholders	100	100
Minimum nominal number of shares as a percentage of the total company shares	10%	10%
Minimum number of free float as a percentage of the total company shares	5%	5%
Minimum issued and paid up capital	LE 20 million	LE 20 million
Minimum number of issued shares	2 million	2 million
Minimum net profit before taxes as a percentage of issued capital	5%	5%
Shareholders' equity	Not less than total issued and paid up capital	Not less than total issued and paid up capital

Source: The Egyptian Exchange Year Book, 2008.

A new listing rules are introduced on October 2008 based on the law no. 123 of Year 2008. These new listing rules abolished the Official and Unofficial Schedules and used "the Egyptian securities schedule" to list Egyptian securities, and "the foreign securities schedule" to list foreign securities (The Egyptian Exchange Year Book, 2008). These new listing rules are indicated in Table 2.3.

The comparison between Tables 2.2 and 2.3 shows that most requirements in Table 2.3 are the same as the requirements for listing on the Official Schedules in Table 2.2. However, the minimum nominal number of shares as a percentage of the total firm shares in Table 2.3 is 10%; which is the same as the requirement in the Unofficial Schedule "1" in Table 2.2. In addition, the minimum number of shareholders after the IPO is 100 in Table 2.3 compared with 150 in the Official Schedule "1" and 50 in the Unofficial Schedule "1" in Table 2.2. Moreover, the requirement of the minimum years of operations in Table 2.2 is not included in Table 2.3. Finally, 5% minimum number of free float as a percentage of the total firm shares is added to the new listing rules shown in Table 2.3.

Table 2.3 also shows that the Egyptian and foreign securities have the same listing requirements. Nevertheless, there are two additional requirements are mandated for stock listing on the foreign securities schedules. Firstly, shares have to be cross listed on a regulated foreign exchange and to be denominated in convertible foreign currency. Secondly, the financial statements should be prepared and reviewed according to the Egyptian accounting and auditing standards or the American/ international accounting and auditing Standards (The Egyptian Exchange Year Book, 2008). In general, the new listing rules issued on October 2008 impose somewhat similar requirements to that of the old Official Schedules illustrated in Table 2.2, but stricter requirements than that imposed by the Unofficial Schedules. The purpose of raising listing requirements is to ensure the high quality of listed firms, and hence to prevent these firms from the later involuntary delisting.

Each listed firm must provide its annual financial statements to the EGX, including an audit report from its external auditor within 90 days after the financial year. It should also provide quarterly financial statements to the EGX, including a limited audit report from its external auditor within 45 days from the end of each quarter. If the firm does not comply with the listing rules, it may be delisted (Abdel Shahid, 2003; The Egyptian Exchange Year Book, 2008). This requirement of ongoing disclosure is similar to the analogous requirements in the U.S (Blowers et al., 1995).

2.7.3 Involuntary Delisting

The law 123/2008 mentioned the following cases for involuntary delisting (The Egyptian Exchange Year Book, 2008):

- If listing is made based on false information that affect the validity of listing.
- If the firm does not comply with disclosure rules after one month from receiving a notification from the EGX.
- If the foreign securities represented by the EDRs are delisted.
- If there is no trading on the firm's shares for six consecutive months.
- If the firm does not pay the listing fees.
- If the firm violates one of the listing rules and regulations.

2.8 SUMMARY

This chapter presents information about the Egyptian Stock Exchange (EGX), and the IPO market in Egypt. The history of the EGX is shown in the first section of this chapter, followed by some information with regard to the Egyptian privatization program. Then, the main laws and indices of the EGX are presented chronologically. These laws include the Corporate Law No. 159/1981, the Privatization Law No. 203/1991, the Capital Market Law No. 95/1992, the Investment Law No. 8/1997, the Central Depository Law No. 93/2000, and the Capital Market Law No. 123/ 2008. In addition, the EGX indices are the Capital Market Authority Index, the EGX 30 Index, Dow Jones Egypt Titans 20 Index, S&P/EGX ESG Index, Sector Indices, the EGX 70 Index, and the EGX 100 Index. The Capital Market Authority Index contains two indices, namely the Public Egyptian Index and the Closed Egyptian Index. The Public Egyptian Index is used in this study because it includes all publicly traded firms.

The remaining part of this chapter is dedicated to discuss the mechanisms formed to protect small and outside shareholders in the EGX, the Egyptian IPO

market, and both listing requirements and involuntary delisting cases in the EGX. There are two listing schedules in the EGX, namely the Official Schedule and the Unofficial Schedule. Listing requirements in the Official Schedule are stricter than those in the unofficial one. Thus, delisting risk is expected to be higher in firms listed on the unofficial schedule, which usually include small, young, and unknown firms.

In addition, listing rules are updated on August 2002. These new rules are enforced immediately on all firms listed on August 2002 onwards. However, they are imposed on September 2003 on all firms listed before August 2002. These new rules are more stringent than the old ones. They have also permitted the involuntary delisting of bad firms. Therefore, higher delisting risk is expected in firms listed after imposing the new listing rules. Listing type and listing rules variables are new variables extracted from the Egyptian context, and their relationships with delisting risk need to be tested.

After presenting an overview about the Egyptian Stock Exchange and IPO market, the related theoretical and empirical evidence is discussed in the following chapter.

CHAPTER 3

LITERATURE REVIEW

3.1 INTRODUCTION

This chapter consists of three main sections. Section 3.2 discusses the theories related to delisting risk. This section is divided into two subsections. In Section 3.2.1 the related theories of IPO long-run performance are presented. These theories include agency theory, signaling theory, certification hypothesis, window of opportunity hypothesis, marketing event hypothesis, and behavioral explanations of long-run underperformance. Then, Section 3.2.2 presents other theories related to delisting risk, namely resource-based theory, trade-off theory, efficient monitoring hypothesis, and both conflict of interest and strategic alignment hypotheses.

Section 3.3 discusses related empirical literature on delisting risk of IPO firms. This literature is classified according to the objectives of study into three groups. The first group includes prior studies related to the determinants of delisting rate. The second group contains related studies on the determinants of survival time. Finally, there are some studies that examine both delisting rate and survival time. These studies are presented in the third group. This chapter ends with a conclusion in Section 3.4.

3.2 THEORIES RELATED TO DELISTING RISK OF IPOs

3.2.1 Theories of Long-Run Performance of IPOs

Theories of IPOs performance are classified into underpricing theories and long-run performance theories. Several theories are employed to explain underpricing (Algebaly, Ahmad-Zaluki, & Ibrahim, 2008). However, the theoretical explanations for the long-run returns of IPOs are less abundant (Jenkinson & Ljungqvist, 2001). This study employs long-run performance theories to understand the determinants of delisting risk in the IPO market as follows:

3.2.1.1 Agency Cost Hypotheses

Jensen and Meckling (1976) introduced the interest convergence theory. According to them, higher managerial ownership concentration leads to better alignment of interests between managers and shareholders, and thus fewer agency costs. In the IPO context, this theory means that if insider ownership increases, agency costs will decrease. As a result, firm performance will ameliorate, and delisting risk will decrease.

The conflict of interest between managers and shareholders is also studied by Morck et al. (1988) in their entrenchment theory, which has the opposite conclusion of the interest convergence theory. They argue that high levels of managerial ownership concentration may prevent the possibility of hostile takeover. In addition, managerial ownership concentration may lead managers to achieve private benefits at the expense of minority shareholders (Jenkinson & Ljungqvist, 2001). In other

words, the entrenchment theory predicts that high levels of managerial and insider ownership concentration will worsen firm performance and increase delisting risk.

3.2.1.2 Signaling Hypotheses

Signaling hypotheses argue that there is information asymmetry between issuers and investors, where issuers have more information. High quality issuers underprice their IPOs to signal their quality and to leave a good taste in investors' mouths, which means the possibility of coming back to the market to sell additional securities on more favorable terms (Allen & Faulhaber, 1989; Grinblatt & Hwang; 1989; Welch, 1989). The high costs of underpricing may ban low quality firms from offering their shares with high underpricing. Additionally, the real quality of low quality firms may be detected within the period from the IPO to the seasoned equity offering (SEO). That is, the main advantage gained from underpricing is difficult to be realized in low quality firms.

In addition, insider ownership can be considered as a signal of a firm's quality according to the signaling hypothesis of Leland and Pyle (1977), and Grinblatt and Hwang (1989). Thus, signaling hypotheses predict that there is a positive relationship between both underpricing and insider ownership as independent variables and firm performance as a dependent variables. Therefore, it could be inferred from the signaling hypotheses that delisting risk will decrease with the increase in both IPOs underpricing and insider ownership.

3.2.1.3 Certification Hypothesis

This hypothesis argues that reputable underwriters¹², prestigious auditors, and venture capitalists have a certification role which reduces risk in the IPO process. They certify that offer prices reflect all relevant information about the IPO firm (Carter & Manaster, 1990; Megginson & Weiss, 1991; Clarkson & Merkley, 1994; Hensler et al., 1997; Choi & Nam, 1998). This certification role can be considered as an indicator of firm's quality. For example, in Carter and Manaster (1990) model, known as "the underwriter's reputation hypothesis", less risky IPOs are underwritten by reputable underwriters and less reputable underwriters underwrite riskier IPOs. Consequently, their model predicts that underwriter's reputation is negatively associated with risk. Thus, it could be concluded that the existence of reputable underwriters, prestigious auditors, and venture capitalists in the IPO process may reduce delisting risk.

3.2.1.4 Window of Opportunity Hypothesis

Ritter (1984, 1991) and Loughran and Ritter (1995) developed this hypothesis. According to them, investors are overoptimistic about the expected earnings of firms that go public in hot issue periods, which have large number of IPOs. This overoptimism leads to a strong demand for IPOs. In turn, many poor performing firms enter to the market through IPOs in these hot periods to benefit from investors' overoptimism. Thus, firms which offer their IPOs in hot issue periods are more expected to underperform other IPOs in the long-run. As a result, it

¹² Underwriters and investment bankers are used interchangeably.

could be concluded that firms which offer their IPOs in hot issue periods are more expected to expose to involuntary delisting.

3.2.1.5 Marketing Event Hypothesis

According to this hypothesis, underpricing can be used as a means for firm's publicity. Chemmanur (1993) argues that this publicity could attract additional investors to invest in firm's shares. Demers and Lewellen (2003) also claim that this publicity could increase the awareness of firm's brand. Consequently, additional revenues would be generated from selling firm's products. Thus, this hypothesis argues that high underpricing improves both long-run stock price performance and firm's operating performance. This improvement decreases delisting risk.

3.2.1.6 Behavioral Explanations of Long-Run Underperformance

Divergence of opinion hypothesis of Miller (1977), speculative bubble hypothesis of Ritter (1984), overreaction hypothesis of De Bondt and Thaler (1985, 1987), fads hypothesis of Aggarwal and Rivoli (1990), and stabilization hypothesis of Ruud (1993) rely on behavioral explanations to justify that high underpricing of IPOs will be followed by long-run share price underperformance. So, it is preferred to discuss these hypotheses in the same section.

The divergence of opinion hypothesis of Miller (1977) suggests that the most optimistic investors of an IPO are those who will buy it. If there is a great uncertainty about the value of an IPO, differences of opinion between optimistic and pessimistic

investors will exist. As information increases over time, the divergence of expectations decreases and prices are, consequently, adjusted downwards.

In addition, the Speculative Bubble Hypothesis of Ritter (1984) argues that oversubscription leads to high initial returns by increasing speculative demand in the first days of trading for investors who could not get allocations in the primary market. In other words, there is a temporary overvaluation of IPOs caused by investors' overoptimism. This overvaluation is known as "fads" in the fads' hypothesis of Aggarwal and Rivoli (1990), and "overreaction" in the overreaction hypothesis of De Bondt and Thaler (1985, 1987). However, the speculative demand decreases in the long-run causing the burst of speculative bubble (Ritter, 1984). In other words, the market corrects the overvaluation in the long-run causing a negative relationship between initial returns and long-run returns (De Bondt & Thaler, 1985, 1987; Aggarwal & Rivoli, 1990).

Stabilization hypothesis is introduced by Ruud (1993). It is also known as "price support hypothesis". Ruud (1993) argues that underwriters may support share prices over a short period of time after going public. During support period, prices of securities are kept artificially high by underwriters. Once underwriters' support is ended, prices will fall to the true market equilibrium causing abnormal long-run underperformance.

All previously mentioned behavioral explanations of long-run underperformance report that there is high underpricing of IPOs followed by long-run underperformance. The long-run underperformance may cause high delisting

risk. Thus, all previously discussed behavioral hypotheses predict a positive relationship between underpricing and delisting risk.

3.2.2 Other Theories Related to Delisting Risk of IPOs

3.2.2.1 Resource-Based Theory

The resource-based theory is developed by Wernerfelt (1984) and Barney (1991). According to them, firms should be analyzed from the resource side rather than the product side. Each firm could be viewed as a group of tangible and intangible resources. The ability of a firm to develop and sustain unique resources affects its competitive advantage, and its performance and survivability accordingly (Esteve-Pérez & Mañez-Castillejo, 2008).

3.2.2.2 Trade-off theory of capital structure

The trade-off theory of capital structure argues that the optimal debt level is the level that balances between the advantage of tax shields and the cost of financial distress (Brealey, Myers, & Marcus, 2001). It could be concluded from this theory that financial distress and delisting risk are expected to increase in firms with high leverage.

3.2.2.3 Efficient Monitoring Hypothesis

According to the efficient monitoring hypothesis of Pound (1988), firm performance is expected to be better in firms with high institutional ownership. He attributes that to the high monitoring role of institutional investors over the actions of

management in their firms; because they have their own analysts who can evaluate firm's performance. This hypothesis is confirmed empirically by Balatbat et al. (2004), among others. Therefore, firms with high institutional ownership are expected to survive longer than other firms, and hence to have less delisting risk.

3.2.2.4 Conflict of Interest and Strategic Alignment Hypotheses

These two hypotheses are developed and supported empirically by Pound (1988). The conflict of interest hypothesis states that institutional investors support management actions because they have investment and business relationship with them. For example, an insurance company may hold a significant percentage of firm's shares and acts as its primary insurer at the same time. The strategic alignment hypothesis proposes that institutional investors and managers find it is mutually beneficial to cooperate. Both hypotheses predict less monitoring over the management actions, and bad firm performance accordingly. Therefore, these two hypotheses state that firms with high institutional ownership are expected to survive shorter than other firms, and hence to have more delisting risk.

3.3 RELATED EMPIRICAL STUDIES ON THE DETERMINANTS OF DELISTING RISK IN THE IPO MARKET

Three groups of prior studies related to delisting risk of IPOs are presented in this section according to research objectives. The first group includes prior studies on the determinants of IPO's delisting rate. The second group contains prior studies on the determinants of survival time in the IPO market. Finally, prior studies which discuss both delisting rate and survival time are presented in the third group. In addition, high quality firms are expected to have less delisting, financial distress, and

bankruptcy risks. They are also expected to have better long-run stock and operating performance. Thus, the determinants of financial distress risk, bankruptcy risk, and long-run performance may help in identifying and understanding the determinants of delisting risk. Therefore, three additional groups of prior studies related to the determinants of IPOs long-run stock performance, the determinants of IPOs long-run operating performance, and the determinants of financial distress and bankruptcy risks are summarized in Appendices 2, 3, and 4, respectively.¹³

3.3.1 Prior Studies on the Determinants of IPO's Delisting Rate

Schultz (1993) is one of the earliest researchers who study the determinants of delisting rate. He examines 797 IPOs in the U.S offered from 1986 to 1988 based on binary logistic regression model. His sample includes 167 unit IPOs and 630 share IPOs. He finds that unit offerings are more likely to be delisted within two and three years after the offering because their issuing firms have greater uncertainty about their prospects. In addition, initial returns variable has a significant negative relationship with one-year delisting rate. He also reports that delisting rate has significant negative associations with offering size, firm's age, and underwriter's prestige for two- and three-year periods.

Platt (1995) analyzes the determinants of three-year delisting rate, due to bankruptcy, based on logistic regression model. His sample includes 108 IPOs issued in the U.S over the 1980-1988 period. He finds that the main significant positive predictors of delisting rate are interest expense to cash ratio, inventory to cash flow ratio, and long-term debt to cash flow ratio.

¹³ The three additional groups of prior studies are not discussed in this section because they are indirectly related to delisting risk.

Chen and Schoderbek (1999) examine the main determinants of involuntary delisting process used by the American Stock Exchange (AMEX) based on 150 IPOs issued from 1981 to 1992. They use the logistic regression analysis and report that financial data play a secondary role in comparison to that played by other factors mentioned in delisting applications in predicting delisting rate. More specifically, the results indicate that audit opinions, Chapter 11 filings, firms' trading volume, shareholder lawsuits and SEC investigations, and one-year stock return prior to delisting are significant determinants for involuntary delisting. However, in many cases the AMEX does not follow the criteria outlined in the financial guidelines.

The study of Jain and Kini (1999b) is one of the main and earliest studies in investigating the determinants of the transition probability to one of the post-IPO states i.e., delisting, survival, or acquiring. This study is summarized and discussed by Espenlaub (1999). Jain and Kini (1999b) employ multinomial logistic regression model to investigate 877 American IPOs issued over the 1977-1990 period. They trace the status of each IPO firm for five years after the offering. They find that firms with higher total risk and lower underwriter prestige have significantly higher probability of delisting relative to survival or acquisition. In addition, offering size, industry R&D intensity, and pre-IPO profitability positively affect the probability of survival relative to delisting or being acquired. However, venture capital (VC) backing and insider ownership variables, among others, are found to have insignificant relationships with the probability of delisting.

Similar to the study of Jain and Kini (1999b), the studies of Bhabra and Pettway (2003), and Peristiani (2003) employ a comprehensive set of independent variables to identify the determinants of involuntary delisting rate. Based on 242 IPOs in the U.S issued between 1987 and 1991, Bhabra and Pettway (2003) examine a set of firm and offering characteristics obtained from IPO prospectuses as potential explanatory variables for firms' delisting rate. The results of the binary logistic regression models show that prospectus information is useful in predicting five-year involuntary delisting rate. More specifically, firm size, profitability, spending on R&D, and offering size to total assets ratio have inversely significant relationships with delisting rate. In addition, the probability of involuntary delisting increases significantly with the increase in the number of risk factors. However, firm's age, financial leverage, tangibility of assets, initial return, management sales of firm's shares at the IPO, VC backing, and underwriter prestige variables associate insignificantly with the likelihood of compulsory delisting.

The study of Peristiani (2003) investigates 6974 American firms that issued IPOs over the period of 1980-2000. He employs logistic regression model to identify the main explanatory variables of the mandatory probability of delisting. Consistent with expectation, he reports significant negative relationships between delisting rate and firm size, liquidity, profitability, stock excess return, and R&D expenditures. In addition, internet firms exhibit higher delisting rate than other firms. However, contrary to expectation, the probability of involuntary delisting increases in firms with high total assets turnover and those with high market share of the lead underwriter. It also increases in firms underwritten by reputable underwriters and those backed by venture capitalists.

The relationship between the presence of auditor's going concern opinion on pre-IPO financial statements and the likelihood of mandatory delisting based on two years survival time is examined by Willenborg and McKeown (2001). The sample of their study includes 270 IPOs issued in the U.S from 1993 to 1994. This relationship is significantly positive based on the results of the probit model. In addition, the increase in profitability and offering size significantly decrease the probability of involuntary delisting. Furthermore, a significant positive association is found between delisting rate and both the inventory to pre-IPO assets and unit offerings. However, firm's age and size, financial leverage, interest expense to liquid assets, and underwriter prestige variables are not significant in their study.

Based on 95 IPOs issued in the U.S in 1992, Wilbon (2002) examines the influence of five dimensions of research and development (R&D) management on the survival of high-technology firms based on the logistic regression analysis. These dimensions include the scope of R&D projects, R&D spending, sourcing of technology, executive technology experience, and Intellectual property rights. He also uses two control variables, namely firm's age and three-year average return on equity (ROE). The non-survivor firms are defined in his study as the voluntary and involuntary delisted firms within five years after the offering. He finds that intellectual property rights, executive technology experience, and ROE have significant positive relationships with survival. However, contrary to expectation, R&D spending has a significant negative association with it. Firm's age, R&D scope, and technology sourcing variables are not significant variables in Wilbon's study.

Fama and French (2004) examine the impact of assets growth rate, profitability, and firm size on the involuntary delisting rate in 339 American IPO firms during the first ten years after the IPO over the period of 1973-2001. However, their study relies on descriptive analysis instead of a rigorous inferential statistical analysis as in the previously discussed studies. They find that delisting rate decreases with the increase in return on assets, the increase in firm size, and the decrease in growth rate in assets.

The association between both board of directors and ownership characteristics, as corporate governance variables, and the three-year involuntary delisting rate from NYSE is examined by Charitou et al. (2007). They employ logistic regression analysis to investigate 161 IPOs issued in the U.S from 1998 to 2004. Their findings indicate that firms with more independent boards and greater insider ownership are generally less likely to become delisted. In addition, firm size measured by total assets, growth measured by market to book equity ratio, profitability measured by return on assets, and financial leverage measured by debts ratio are used as control variables in this study. All these variables, except financial leverage, are found to have significant negative relationships with delisting rate.

In a more recent study, Yung et al. (2008) examine the relationship between IPO activity and the likelihood of involuntary delisting in 3198 firms in the U.S that issued IPOs from 1973 to 2004. They use three and five years after the offering to identify the survivor and delisted firms. The findings of their study report that IPO activity increases the probability of involuntary delisting significantly after controlling for other variables, namely firm size, firm's age, offer price, VCs

participation, underwriter's prestige (which have significant negative relationships with delisting rate), financial leverage, selling, general, and administrative expenses (which have significant positive relationships with delisting rate), and initial return (which has insignificant relationship with delisting rate). In other words, IPO firms issued in hot issue periods are more likely to be delisted involuntarily compared with firms issued in cold issue periods.

Table 3.1 summarizes the previously discussed studies related to the determinants of delisting rate as follows:

Table 3.1 Summary of selected prior studies on the determinants of IPO's delisting rate

Author[s] (Year of study)	Sample size Country (Period examined)	Dependent variable (Statistical technique (s))	Independent variables (<i>Relationship with delisting rate</i>)
Schultz (1993)	797 IPOs "167 unit IPOs and 630 share IPOs" U.S (1986-1988)	One-, two-, and three-year involuntary delisting rate (Logistic regression model)	<ul style="list-style-type: none"> - Firm's age (<i>Significant negative relationship within 2 years</i>) - Offering size (<i>Significant negative relationship within 2 and 3 years</i>) - Initial return (<i>Significant negative relationship within 1 year after the IPO</i>) - Underwriter prestige (<i>Significant negative relationship within 2 and 3 years</i>) - Unit offering (<i>More likely to be delisted within 2 and 3 years after the IPO</i>)
Platt (1995)	108 firms U.S (1980-1988)	Three-year involuntary delisting rate (Logistic regression model)	<ul style="list-style-type: none"> - Industry adjusted long-term debt to cash flow ratio (<i>Significant positive relationship</i>) - Industry adjusted inventory to cash flow ratio (<i>Significant positive relationship</i>) - Industry adjusted interest expense to cash ratio (<i>Significant positive relationship</i>)
Jain and Kini (1999b)	877 firms U.S (1977-1990)	Five-year involuntary delisting rate (Logistic regression model)	<ul style="list-style-type: none"> - Profitability measured by operating return on assets (<i>Significant negative relationship</i>) - Ln offering size (<i>Significant negative relationship</i>) - Venture-Capital [VC] backing (<i>Insignificant relationship</i>) - Insider ownership (<i>Insignificant relationship</i>) - Underwriter prestige (<i>Significant negative relationship</i>) - Aftermarket standard deviation of daily returns (<i>Significant positive relationship</i>) - Valuation uncertainty (<i>Insignificant relationship</i>) - Pre-IPO demand (<i>Insignificant relationship</i>)

Table 3.1 (continued) Summary of selected prior studies on the determinants of IPO's delisting rate

Author[s] (Year of study)	Sample size Country (Period examined)	Dependent variable (Statistical technique (s))	Independent variables (<i>Relationship with delisting rate</i>)
			<ul style="list-style-type: none"> - Industry market-to-book ratio (<i>Insignificant relationship</i>) - Industry R&D intensity (<i>Significant negative relationship</i>) - Industry concentration (<i>Insignificant relationship</i>) - Corporate focus (<i>Insignificant relationship</i>) - R&D dissimilarity with industry (<i>Insignificant relationship</i>) - Advertising dissimilarity with industry (<i>Insignificant relationship</i>) - Capital expenditure dissimilarity with industry (<i>Insignificant relationship</i>)
Willenborg and McKeown (2001)	270 firms U.S (1993-1994)	Two-year involuntary delisting rate (Probit regression model)	<ul style="list-style-type: none"> - The presence of auditor's going concern opinion (GC) on pre-IPO financial statements (<i>Significant positive relationship</i>) - Ln firm's age (<i>Insignificant relationship</i>) - Firm size measured by the natural log of total assets (<i>Insignificant relationship</i>) - Financial leverage measured by long-term debt to pre-IPO assets (<i>Insignificant relationship</i>) - Interest expense to liquid assets (<i>Insignificant relationship</i>) - Inventory to pre-IPO assets (<i>Significant positive relationship</i>) - Profitability measured by return on assets (<i>Significant negative relationship</i>) - Ln offering size (<i>Significant negative relationship</i>) - Underwriter prestige (<i>Insignificant relationship</i>) - Unit offering (<i>Significant positive relationship</i>)
Wilbon (2002)	95 high-tech firms U.S (1992)	Five-year delisting rate "Both voluntarily and involuntarily" (Logistic regression model)	<ul style="list-style-type: none"> - Firm's age (<i>Insignificant relationship</i>) - Profitability measured by return on equity (<i>Significant negative relationship</i>) - R&D spending (<i>Significant positive relationship</i>) - R&D scope (<i>Insignificant relationship</i>) - Technology sourcing (<i>Insignificant relationship</i>) - Executive technology experience (<i>Significant negative relationship</i>) - Intellectual property rights (<i>Significant negative relationship</i>)
Bhabra and Pettway (2003)	242 firms U.S (1987-1991)	Five-year involuntary delisting rate (Logistic regression model)	<ul style="list-style-type: none"> * <u>Firm Characteristics</u> - Firm's age (<i>Insignificant relationship</i>) - Firm size measured by log of total assets (<i>Significant negative relationship</i>) - Financial leverage (<i>Insignificant relationship</i>) - Profitability (<i>Significant negative relationship</i>) - Tangibility of assets (<i>Insignificant relationship</i>) - Spending on R&D (<i>Significant negative relationship</i>) * <u>Offering Characteristics</u> - Offering size to total assets ratio (<i>Significant negative relationship</i>) - Initial return (<i>Insignificant relationship</i>) - Management sales of firm shares at the IPO (<i>Insignificant relationship</i>) - VC backing (<i>Insignificant relationship</i>)

Table 3.1 (continued) Summary of selected prior studies on the determinants of IPO's delisting rate

Author[s] (Year of study)	Sample size Country (Period examined)	Dependent variable (Statistical technique (s))	Independent variables (<i>Relationship with delisting rate</i>)
			<ul style="list-style-type: none"> - Underwriter prestige (<i>Insignificant relationship</i>) - Number of risk factors (<i>Significant positive relationship</i>)
Peristiani (2003)	6974 firms U.S (1980-2000)	Involuntary delisting rate (Logistic regression model)	<ul style="list-style-type: none"> - Survival time period (<i>Insignificant relationship</i>) - Firm size measured by the natural log of market capitalization (<i>Significant negative relationship</i>) - Liquidity measured by working capital to total assets (<i>Significant negative relationship</i>) - Assets turnover ratio (<i>Significant positive relationship</i>) - Profitability measured by return on assets (<i>Significant negative relationship</i>) - VC backing (<i>Significant positive relationship</i>) - Market volatility (<i>Significant positive relationship</i>) - Stock excess return (<i>Significant negative relationship</i>) - R&D expenditures (<i>Significant negative relationship</i>) - Internet firms (<i>Significant higher delisting rate in internet firms</i>) - Market share of the lead underwriter (<i>Significant positive relationship</i>) - Underwriter reputation (<i>Significant positive relationship</i>)
Fama and French (2004)	339 firms U.S (1973-2001)	Ten-year involuntary delisting rate (Descriptive statistics)	<ul style="list-style-type: none"> - Growth rate in assets (<i>Positive relationship</i>) - Profitability measured by earnings before debts but after taxes to assets (<i>Negative relationship</i>) - Firm size measured by total assets (<i>Negative relationship</i>)
Charitou et al. (2007)	161 firms U.S (1998-2004)	Three-year involuntary delisting rate (Logistic regression model)	<ul style="list-style-type: none"> - Firm size measured by total assets (<i>Significant negative relationship</i>) - Financial leverage measured by debts ratio (<i>Insignificant relationship</i>) - Growth measured by market to book equity ratio (<i>Significant negative relationship</i>) - Profitability measured by return on assets (<i>Significant negative relationship</i>) - Insider ownership (<i>Significant negative relationship</i>) - Percentage of outside directors (<i>Significant negative relationship</i>) - Board size (<i>Insignificant relationship</i>) - Three-year cumulative board meetings (<i>Insignificant relationship</i>)
Yung et al. (2008)	3198 IPO firms "207 (354) of which were delisted within three (five) years from the IPO date" U.S (1973-2004)	Three and five-year involuntary delisting rate (Logistic regression model)	<ul style="list-style-type: none"> - IPO activity (<i>Significant positive relationship</i>) - Ln firm's age (<i>Significant negative relationship</i>) - Ln firm size (<i>Significant negative relationship</i>) - Financial leverage measured by debts ratio (<i>Significant positive relationship</i>) - Initial return (<i>Insignificant relationship</i>) - VC backing (<i>Significant negative relationship</i>) - Underwriter prestige (<i>Significant negative relationship</i>) - Offer price (<i>Significant negative relationship</i>) - Ln selling, general, and administrative expenses (<i>Significant positive relationship</i>)

3.3.2 Prior Studies on the Determinants of IPO's Survival Time

This group of studies focuses on the determinants of survival time in the IPO market based on the survival time analysis. The study of Hensler et al. (1997) is one of the earliest and most important studies in examining the determinants of IPOs survival time. They employ accelerated failure time (AFT) model to investigate 741 IPOs issued in the U.S over the period of 1976-1984. They find that the survival time for IPOs has significant positive relationships with the firm's age and size, IPO activity level, initial return, and insider ownership percentage. However, it is inversely related to the number of risk factors and market level at the IPO date. In addition, survival time differs significantly across industries. More specifically, IPOs trade longer if they are from the optical or the drug industries, and shorter if they are from the computer and data processing, wholesale, restaurant, or airlines industries.

Jain and Kini (2000) study whether the presence of venture capitalists (VCs) improves the survival profile of IPO firms. They examine 877 IPO firms offered in the U.S market from 1977 to 1990 based on Cox proportional hazards regression model. They find that the existence of VCs enhances the survivorship of IPO firms. In addition, the IPO survival time lengthens with the increase in R&D expenses to total assets, the existence of reputable underwriters, the increased number of unaffiliated researchers, the high insider ownership retention after excluding acquired firms from the non-survivors group, and the success in the road show. However, offering size and the number of affiliated research coverage are not significantly related to survival time in the Cox regression model. The study of Jain and Kini (2000) is summarized and discussed by Khurshed (2000).

Peristiani and Hong (2004) use hazard regression model to investigate 8918 U.S IPOs issued between 1980 and 2000. They report that older firms, firms with high profitability measured by return on assets, and those with high level of insider ownership have significantly better survival rates compared with other firms.

A leading research in regard to the relationship between the quality of auditor and post-IPO survival profile is conducted by Jain and Martin Jr (2005) on 800 U.S firms issued over the period 1980-1990. They rely on both the Kaplan-Meier survival analysis and Cox proportional hazards model. The main finding of their study confirms that the survival profile of IPO firms improves significantly with the presence of reputable auditors at the IPO time. In addition, the relationship between the auditor's quality and survival time is stronger when underwriter's reputation is low. Furthermore, firm's age, offering size, underwriter's prestige, and the number of analysts have significant positive relationships with survival time.

In Taiwan, Yang and Sheu (2006) examine the association between managerial ownership and the survival of 560 IPO firms within the period from 1992 to 2000. They use two multivariate survival time techniques, namely AFT model and Cox proportional hazards regression model. They find a U shaped relationship between insider ownership and IPO survival time. In addition, they find an evidence of a significant positive relationship between officer to insider holding ratio and IPO survivability. Furthermore, older firms have significantly longer survival time compared with younger ones. However, offering size, IPO activity, initial return, director to insider holding ratio, and market level variables have insignificant relationships with survival time.

Jain and Kini (2008) study the influence of four strategic investment variables on the survivability of American IPO firms, namely the extent of diversification, R&D expenditure, capital expenditure, and advertising expenditure. They investigate 3837 IPOs issued over the 1980-1997 period based on Cox proportional hazard regression model. They find that the extent of diversification and industry-adjusted R&D intensity are significant positive determinants for survival time of IPO firms. Contrary to expectation, capital and advertising expenditures have significant negative relationships with the time to failure. In addition, all control variables used in their study have the expected sign. More specifically, offering size, VC backing, managerial ownership retention, underwriter prestige, and operating return on assets associate positively in significant relationships with survival time. Furthermore, the increase in IPO risk, measured by the standard deviation of aftermarket returns, shortens the survivability of IPO firms significantly.

A specialized study on the determinants of IPO survival in American internet firms is introduced by Goot, Giersbergen and Botman (2009). They employ both AFT model and Cox proportional hazards model to analyze 326 internet IPOs offered between December 1996 and February 2001. They find that insider ownership, underwriter reputation, investor demand, and short-term liquidity, measured by operational cash flow over liabilities, have significant positive relationships with survival time. In addition, the number of risk factors, valuation uncertainty and IPO market level associate negatively with survival time in significant relationships. However, the age of internet activities, firm size, receivables over total assets, offer to book ratio, and operating efficiency have insignificant relationship with the time to failure.

In a more recent study, Lamberto and Rath (2010) investigate 20 variables as potential determinants for IPO survival in 154 Australian IPOs issued over the period of 1995-1997. They use Cox proportional hazards model to analyze the impact of these variables on IPO survival time. The findings show that the number of risk factors, underwriter backing, and firm size have significant negative associations with firm's survival. However, the negative relationships between survival time and both underwriter backing and firm size variables are not expected. In addition, offering size and forecast dividend yield have significant positive relationships with survival time. The likelihood of survival also varies across industries. It increases in firms in the finance and natural resources industries.

The remaining 14 variables in the study of Lamberto and Rath (2010) are not significant in any Cox regression model employed in their study. These variables are firm's age, financial leverage, liquidity, operating efficiency, profitability, auditor's quality, insider ownership, offer price, earnings to price ratio, attachment of options to the offer, issue costs to offer proceeds, the presence of non-executive chairman, number of directors, and the percentage of independent directors. It is worth noting that nine variables are common between the study of Lamberto and Rath (2010) and the present study. These variables are firm's age, firm size, financial leverage, liquidity, operating efficiency, profitability, offering size, auditor's quality, and insider ownership.

After discussing the related empirical evidence on the determinants of survival time, a summary of these results is presented in Table 3.2 as follows:

Table 3.2 Summary of selected prior studies on the determinants of IPO's survival time

Author[s] (Year of study)	Sample size Country (Period examined)	Survival time analysis technique (s)	Independent variables (<i>Relationship with survival time</i>)
Hensler et al. (1997)	741 firms U.S (1976-1984)	Accelerated failure time [AFT] model	<ul style="list-style-type: none"> - Firm's age (<i>Significant positive relationship</i>) - Firm size (<i>Significant positive relationship</i>) - IPO activity (<i>Significant positive relationship</i>) - Market level (<i>Significant negative relationship</i>) - Initial return (<i>Significant positive relationship</i>) - Insider ownership (<i>Significant positive relationship</i>) - Industry type (<i>Survival time differs significantly across industries</i>) - Number of risk factors (<i>Significant negative relationship</i>)
Jain and Kini (2000)	877 firms U.S (1977-1990)	Cox proportional hazards regression model	<ul style="list-style-type: none"> - Ln offering size (<i>Insignificant relationship</i>) - VC backing (<i>VC backed firms have significantly longer survival time</i>) - Insider ownership (<i>Significant positive relationship after excluding acquired firms from the non-survivors group</i>) - Underwriter prestige (<i>Significant positive relationship</i>) - R&D to total assets (<i>Significant positive relationship</i>) - Number of Unaffiliated research coverage (<i>Significant positive relationship</i>) - Number of affiliated research coverage (<i>Insignificant relationship</i>) - Success in the road show (<i>Significant positive relationship</i>)
Peristiani and Hong (2004)	8918 firms U.S (1980-2000)	Cross-sectional hazard regression model	<ul style="list-style-type: none"> - Firm's age (<i>Significant positive relationship</i>) - Profitability measured by return on assets (<i>Significant positive relationship</i>) - Insider ownership (<i>Significant positive relationship</i>)
Jain and Martin Jr (2005)	800 firms U.S (1980-1990)	Kaplan Meier method and Cox proportional hazards regression model	<ul style="list-style-type: none"> - Ln firm's age (<i>Significant positive relationship</i>) - Ln offering size (<i>Significant positive relationship</i>) - Auditor's quality (<i>Significant positive relationship</i>) - Underwriter's prestige (<i>Significant positive relationship</i>) - Number of analysts (<i>Significant positive relationship</i>)
Yang and Sheu (2006)	560 firms Taiwan (1992-2000)	AFT model and Cox proportional hazards regression model	<ul style="list-style-type: none"> - Firm's age (<i>Significant positive relationship</i>) - Offering size (<i>Insignificant relationship</i>) - IPO activity (<i>Insignificant relationship</i>) - Initial return (<i>Insignificant relationship</i>) - Total insider ownership (<i>Survival time first decreases and then increases with the total insider ownership percentage at the IPO time, forming a U-shaped relationship</i>) - Officer -to-insider holding ratio (<i>Significant positive relationship</i>) - Director-to-insider holding ratio (<i>Insignificant relationship</i>) - Market level (<i>Insignificant relationship</i>)
Jain and	3837 firms	Cox proportional	- Ln offering size (<i>Significant positive relationship</i>)

Table 3.2 (continued) Summary of selected prior studies on the determinants of IPO's survival time

Author[s] (Year of study)	Sample size Country (Period examined)	Survival time analysis technique (s)	Independent variables (<i>Relationship with survival time</i>)
Kini (2008)	U.S (1980-1997)	hazards regression model	<ul style="list-style-type: none"> - VC backing (<i>Significant positive relationship</i>) - Managerial ownership retention (<i>Significant positive relationship</i>) - Extent of diversification (<i>Significant positive relationship</i>) - Advertising intensity (<i>Significant negative relationship</i>) - Capital expenditure intensity (<i>Significant negative relationship</i>) - R&D intensity (<i>Significant positive relationship</i>) - Underwriter prestige (<i>Significant positive relationship</i>) - Risk of issue (<i>Significant negative relationship</i>) - Profitability measured by operating return on assets one-year before IPO (<i>Significant positive relationship</i>)
Goot et al. (2009)	326 Internet IPO firms U.S (December 1996-February 2001)	Cox proportional hazards regression model, and AFT model	<ul style="list-style-type: none"> - Age of internet activities (<i>Insignificant relationship</i>) - Firm size (<i>Insignificant relationship</i>) - Short-term liquidity measured by: <ul style="list-style-type: none"> * Ln operational cash flow over liabilities (<i>Significant positive relationship</i>) * Ln receivables over total assets (<i>Insignificant relationship</i>) - Offer to book ratio (<i>Insignificant relationship</i>) - Operating efficiency measured by log of assets turnover (<i>Insignificant relationship</i>) - IPO market level (<i>Significant negative relationship</i>) - Insider ownership (<i>Significant positive relationship</i>) - Underwriter reputation (<i>Significant positive relationship</i>) - Investor demand (<i>Significant positive relationship</i>) - Number of risk factors (<i>Significant negative relationship</i>) - Valuation uncertainty (<i>Significant negative relationship</i>)
Lamberto and Rath (2010)	154 IPO firms Australia (1995-1997)	Cox proportional hazards regression model	<ul style="list-style-type: none"> - Firm's age (<i>Insignificant relationship</i>) - Firm size (<i>Significant negative relationship</i>) - Financial leverage measured by long-term debts to total assets (<i>Insignificant relationship</i>) - Liquidity measured by tangibility of assets (<i>Insignificant relationship</i>) - Operating efficiency measured by assets turnover (<i>Insignificant relationship</i>) - Profitability measured by EBIT to total assets (<i>Insignificant relationship</i>) - Offering size (<i>Significant positive relationship</i>) - Quality of auditor (<i>Insignificant relationship</i>) - Insider ownership (<i>Insignificant relationship</i>) - Offer price (<i>Insignificant relationship</i>) - Earnings to price ratio (<i>Insignificant relationship</i>) - Attachment of options to the offer (<i>Insignificant relationship</i>) - Issue costs to offer proceeds (<i>Insignificant relationship</i>) - The presence of non-executive chairman

Table 3.2 (continued) Summary of selected prior studies on the determinants of IPO's survival time

Author[s] (Year of study)	Sample size Country (Period examined)	Survival time analysis technique (s)	Independent variables (<i>Relationship with survival time</i>)
			<i>(Insignificant relationship)</i> - Number of directors (<i>Insignificant relationship</i>) - Percentage of independent directors (<i>Insignificant relationship</i>) - Number of risk factors (<i>Significant negative relationship</i>) - Underwriter backing (<i>Significant negative relationship</i>) - Forecast dividend yield (<i>Significant positive relationship</i>) - Industry type (<i>The likelihood of survival varies significantly across industries. It increases in firms in the finance and natural resources industries</i>)

3.3.3 Prior Studies on the Determinants of IPO's Delisting Risk Measured by both Delisting Rate and Survival Time

Similar to the approach used in the present study, this group includes studies that employ both delisting rate and survival time analyses. Therefore, these studies are the most related to the present study. The studies included in this group are less abundant and relatively recent compared with the results in the first two groups. Similar to the study of Jain and Kini (1999b), the studies of Boubakri, Kooli, and L'Her (2005) and Kooli and Meknassi (2007) use multinomial logistic regression analysis to examine the determinants of the transition probability to delisting, survival or acquiring. However, they focus only on information available in the prospectus. They also employ the AFT model to identify the determinants of survival time.

Boubakri et al. (2005), use a sample of 431 Canadian IPOs issued from 1995 to 1999. They report that prospectus information is important in predicting the survivorship of IPO firms. More specifically, they find that the three-year involuntary delisting rate decreases significantly in firms with larger offering size

and higher initial returns. It increases significantly, however, in IPOs issued in hot issue periods. Further, the IPO survival time increases significantly with the increase in the level of initial return and decreases significantly during hot issue periods and in the real estate industry. Firm's age, VC backing, and underwriter prestige variables are not significant determinants for delisting risk in their study.

Kooli and Meknassi (2007) replicate the study of Boubakri et al. (2005) on the U.S context based on a larger sample size (6235 IPO firms) issued over the 1985-2005 period. However, they omit firm's age variable and add pre-IPO investor's demand variable to their study. They reach to the same conclusion of Boubakri et al. (2005) that prospectus information is an important source to predict the survival profile of IPO firms. More specifically, they find that IPO activity and initial return variables associate positively with three-year delisting rate and negatively with survival time in significant relationships. On the other hand, delisting rate decreases significantly and survival time increases significantly in firms with larger offering size and in firms backed by VCs. Moreover, the survival profile improves in firms underwritten by reputable underwriters and in firms with high pre-IPO investors' demand. It deteriorates, however, in internet firms compared with other firms.

The relationship between earnings management, measured by discretionary current accruals, and IPOs delisting risk is investigated by Li et al. (2006). Their sample includes 3898 IPOs issued in the U.S issued between 1980 and 1999. They use both probit model and Cox proportional hazards model to investigate this relationship. They report identical conclusions from probit and Cox models. More specifically, the association between earnings management and delisting risk is

positive and significant. In regard to the control variables used in their study, financial leverage and stock price volatility have significant positive relationships with delisting risk. In addition, firm size, first trading price, firm's age, income growth, underwriter prestige, and VC backing associate negatively with delisting risk in significant relationships. Furthermore, delisting risk differs significantly across industries. However, the number of outstanding shares variable is not significant in all models used.

Demers and Joos (2007) use accounting and non-accounting information to predict IPO delisting risk in high-tech and non-tech IPOs separately. The sample of their study consists of 3973 IPOs offered in the U.S over the period of 1980-2000, including 502 IPO delisted firms. The determinants of delisting rate based on 3, 4, 5, and 6 survival years are investigated by logistic regression analysis. In addition, Cox regression model is used to identify the determinants of survival time. This study is summarized and discussed by Wysocki (2007).

Demers and Joos (2007) report a significant negative relationship between delisting risk and firm's age and size, profitability, auditor's quality, underwriter reputation, initial return, and offer price in both high-tech and non-tech models. In addition, delisting risk has significant positive association with selling, general and administrative expenses, and financial leverage using both the high-tech and non-tech models. IPOs issued in hot periods have significantly higher delisting risk in the high-tech model, and also in the non-tech model based only on 3 and 4 survival years. Significant relationships are also reported between delisting risk and both R&D expense variable (in a negative relationship) and cumulative deficits variable

(in a positive relationship) based only on the high-tech model. However, VC backing variable is insignificantly related to delisting risk in their study.

A summary of related prior studies on the determinants of delisting risk based on both delisting rate and survival time analyses is shown in Table 3.3.

Table 3.3 Summary of selected prior studies on the determinants of IPO's delisting risk measured by both delisting rate and survival time

Author[s] (Year of study)	Sample size Country (Period examined)	Delisting risk measurement (Statistical technique (s))	Independent variables (<i>Relationship with delisting risk¹⁴</i>)
Boubakri et al. (2005)	431 firms Canada (1995-1999)	- Three-year involuntary delisting rate (Logistic regression model) - Survival time (AFT model)	- Firm's age (<i>Insignificant relationship</i>) - Ln offering size (<i>Significant negative relationship with delisting rate</i>) - IPO activity (<i>Significant positive relationship with delisting risk</i>) - Initial return (<i>Significant negative relationship with delisting risk</i>) - VC backing (<i>Insignificant relationship</i>) - Underwriter prestige (<i>Insignificant relationship</i>) - Industry type (<i>Delisting risk differs significantly across industries. Survival time is significantly shorter in real estate firms</i>)
Li et al. (2006)	3898 firms U.S (1980-1999)	- Five-year involuntary delisting rate (Probit regression model) - Survival time (Cox proportional hazards regression model)	- Earnings management measured by discretionary current accruals (<i>Significant positive relationship with delisting risk</i>) - Ln firm's age (<i>Significant negative relationship with delisting risk</i>) - Ln firm size measured by market capitalization (<i>Significant negative relationship with delisting risk</i>) - Financial leverage (<i>Significant positive relationship with delisting risk</i>) - Income growth (<i>Significant negative relationship with delisting risk</i>) - VC backing (<i>Significant negative relationship with delisting risk</i>) - Stock price volatility (<i>Significant positive relationship with delisting risk</i>) - Ln first trading price (<i>Significant negative relationship with delisting risk</i>) - Ln number of outstanding shares (<i>Insignificant relationship</i>) - Underwriter prestige (<i>Significant negative relationship with delisting risk</i>) - Industry type (<i>Delisting risk differs significantly across industries</i>)
Demers and	3973 IPO	- Three-, four-,	- Ln firm's age (<i>Significant negative relationship with</i>

¹⁴ High (low) delisting risk means high (low) delisting rate and short (long) survival time.

Table 3.3 (continued) Summary of selected prior studies on the determinants of IPO's delisting risk

Author[s] (Year of study)	Sample size Country (Period examined)	Delisting risk measurement (Statistical technique (s))	Independent variables (<i>Relationship with delisting risk^{1,2}</i>)
Joos (2007)	firms including 502 IPO failures. U.S (1980-2000)	five-, and six-year involuntary delisting rate (Logistic regression model) - Survival time (Cox proportional hazards model)	<i>delisting risk</i> - Firm size measured by the log of sales (<i>Significant negative relationship with delisting risk</i>) - Financial leverage (<i>Significant positive relationship with delisting risk</i>) - Profitability measured by gross profit margin (<i>Significant negative relationship with delisting risk</i>) - IPO activity (<i>Significant positive relationship with delisting risk in high-tech model, and also in the non-tech model based on 3 and 4 years</i>) - Auditor's quality (<i>Significant negative relationship with delisting risk</i>) - VC backing (<i>Insignificant relationship with delisting risk</i>) - Underwriter reputation (<i>Significant negative relationship with delisting risk</i>) - Initial return (<i>Significant negative relationship with delisting risk</i>) - Offer price adjusted by the CPI (<i>Significant negative relationship with delisting risk</i>) - R&D expense in the natural log form (<i>Significant negative relationship with delisting risk in high-tech model only</i>) - Ln selling, general, and administrative expenses (<i>Significant positive relationship with delisting risk</i>) - Accumulative deficits before the IPO (<i>Significant positive relationship with delisting risk in high-tech model only</i>)
Kooli and Meknassi (2007)	6235 firms U.S (1985-2005)	- Three-year involuntary delisting rate (Logistic regression model) - Survival time (AFT model)	- Ln offering size (<i>Significant negative relationship with delisting risk</i>) - IPO activity (<i>Significant positive relationship with delisting risk</i>) - Initial return (<i>Significant positive relationship with delisting risk</i>) - VC backing (<i>VC backed firms have significantly less delisting rate and significantly longer survival time</i>) - Underwriter reputation (<i>Firms underwritten by reputable underwriters have significantly longer survival time</i>) - Industry type (<i>Delisting risk differs significantly across industries. Internet firms have significantly shorter survival time</i>) - Investors' demand before the offering (<i>Significant positive relationship with survival time</i>)

After reviewing the related empirical evidence on the determinants of IPOs delisting risk and their related summary presented in Tables 3.1, 3.2, and 3.3, in addition to the three additional categories of studies presented in Appendices 2, 3, and 4, the following conclusions are extracted:

Firstly, prior studies which investigate the determinants of delisting risk are relatively new and concentrated in the U.S market compared with the studies investigating the determinants of IPOs long-run performance and those examining the explanatory variables of financial distress and bankruptcy risks. More specifically, Tables 3.1, 3.2, and 3.3 include 22 studies; 19 studies are executed in the U.S, one study is done in Canada by Boubakri et al. (2005), one study is conducted in Taiwan by Yang and Sheu (2006), and another one is executed in Australia by Lamberto and Rath (2010).

To the best of my knowledge, there is only one study that examines the determinants of long-run IPO returns in the Egyptian market, namely Omran (2005). The main focus of Omran's (2005) study is to identify the determinants of IPO returns, ignoring the risk of these returns. However, there is lack of empirical evidence in regard to the determinants of delisting risk in the Middle East and North Africa (MENA) region. Thus, it is important to identify the determinants of delisting risk in emerging markets such as the Egyptian Stock Exchange.

Secondly, the empirical evidence on the determinants of IPO delisting risk shows mixed results in most variables. For example, firm size variable has a significant negative relationship with delisting risk in some studies (e.g., Hensler et al., 1997; Demers & Joos, 2007; Yung et al., 2008). It has, however, insignificant relationship in the study of Willenborg and McKeown (2001), and has a significant positive relationship in the study of Lamberto and Rath (2010). Although several studies (e.g., Jain & Kini, 2000; Li et al., 2006; Kooli & Meknassi, 2007; Yung et al., 2008) report a significantly less delisting risk in venture capital (VC) backed firms,

some studies (e.g., Jain & Kini, 1999b; Bhabra & Pettway, 2003; Boubakri et al., 2005; Demers & Joos, 2007) find that this association is insignificant. Other studies (e.g., Peristiani, 2003) report a significant positive relationship between VC backing and delisting risk.

In alike manner, the relationship between initial return and delisting risk is significantly negative in the studies of Schultz et al. (1993), Hensler et al. (1997); Boubakri et al. (2005), and Demers and Joos (2007). However, it is significantly positive in the study of Kooli and Meknassi (2007), and insignificant in the studies of Bhabra and Pettway (2003); Yang and Sheu (2006); Yung et al. (2008). The variables of firm's age, financial leverage, liquidity, growth, operating efficiency, profitability, offering size, IPO activity, quality of auditor, and insider ownership have similar conclusions.

Thirdly, nearly all variables examined as potential determinants for delisting risk are also examined as expected determinants for IPO long-run performance and/or for financial distress and bankruptcy risks. Therefore, investigating the studies illustrated in Appendices 2, 3, and 4 gives a rigorous theoretical and empirical background that can help in understanding the determinants of delisting risk. In addition, these studies are the main source of new variables that can be used as potential determinants for delisting risk. To detail, firm type, institutional ownership, listing schedule type, and the Egyptian new listing rules variables are ignored as potential explanatory variables for delisting risk. Firm type variable is found to be a significant determinant for IPO long-run performance in the studies of Menyah et al. (1995), Durukan (2002), Jelic and Briston (2003), Huang and Song (2005), and Peter (2007). In addition, institutional ownership variable is a significant positive

determinant for long-run operating performance in the studies of Sun and Tong (2002) and Balatbat et al. (2004). It also has a significant negative relationship with financial distress risk in the study of Campbell et al. (2008). Listing type variable is also studied by Ahmad-Zaluki et al. (2007), among others, as a potential determinant for long-run stock returns. Moreover, listing variables are extracted from the Egyptian context. Therefore, these variables are taken into account in this study.

Fourthly, the studies of survival time are relatively new compared with the studies of delisting rate. The most recent and related study in regard to the determinants of survival time is the study conducted by Lamberto and Rath (2010). Their study has many setbacks that are avoided in the present study. For example, their study does not test the multicollinearity assumption, although the number of predictors in their full model includes 23 variables (including four dummy variables representing the industry type variable). Thus, the expected multicollinearity between firm size and offering size variables may be the main reason for getting the unexpected negative sign related to firm size variable; which they fail to explain in their study. They also ignore testing the proportional hazards assumption in Cox regression despite its importance. Kruskal-Wallis test is used in their univariate analysis; however the more appropriate univariate analysis of survival time is the Kaplan-Meier analysis. In addition, they do not distinguish between involuntary and voluntary delisting, and treat suspended firms as non-survivors; which is not a common practice. They also calculated financial ratios for the first available year after listing; however it is preferred to calculate these ratios before going public.

Moreover, the definition of survival time adopted in the study of Lamberto and Rath (2010) relies on tracing each IPO firm for five and seven years after the

date of issue; which is also uncommon in the survival literature. It is preferred, however, to trace the survival status from the IPO date until the ending point of their study; which is 31 December 2004. Their definition of survival time leads to a problem known in Cox regression as "tied survival times"; which means that survival times are equal in two cases or more. Specifically, their study has 110 censored cases, out of 154 total firms; which refer to the IPO firms that are survived until the end of the study. Based on their definition of survival time, all these 110 firms will have the same survival time. All these disadvantages resulted in the insignificance of the overall models number 1 and 2 in their study, few significant variables (7 out of 23 variables), and unexpected signs of some variables such as firm size and underwriter backing variables.

Fifthly, most studies of delisting rate determinants ignored the use of probit regression model, and used the logit model instead. The logit model was preferred due to the speed in computing the estimates of its parameters. However, with the availability of related high-speed softwares this advantage is no longer existed and the choice of one model rather than the other is now arbitrary (Brooks, 2008). Thus, it is preferred to employ both models in this study. In addition, some researchers use Cox regression model to identify the determinants of survival time (e.g., Jain & Kini, 2000, 2008; Jain & Martin Jr, 2005; Yang & Sheu, 2006; Demers & Joos, 2007; Lamberto & Rath, 2010). All these studies use Cox proportional hazards model without testing the assumption of proportionality of hazard ratios. Testing this assumption is necessary and is done in this study. Therefore, logit, probit and Cox nonproportional hazards models are employed in this study.

Finally, industry type variable was excluded due to the small sample size, the large number of independent variables used in this study (18 variables), and the various categories of industry type variable. Specifically, IPO firms in this study are classified into 15 sectors. That is, 14 dummy variables are required to represent industry type variable in the multivariate analyses. In addition, stock volatility variable was excluded due to the lack of stock price data related to delisted firms.

3.4 CONCLUSION

The theories and empirical evidence related to the delisting risk in the IPO equity market have been reviewed. The theories related to IPOs include underpricing and long-run performance theories, but this study focuses only on long-run performance theories of IPOs. Long-run performance theories are developed originally to explain underperformance anomaly. However, this study employs these theories in the field of delisting risk. These theories include agency theory, signaling theory, certification hypothesis, window of opportunity hypothesis, marketing event hypothesis, and behavioral explanations of long-run underperformance. In addition, other theories related to IPOs delisting risk are discussed, namely resource-based theory, trade-off theory, efficient monitoring hypothesis, and both conflict of interest and strategic alignment hypotheses.

The second section of this chapter discusses related empirical literature on the determinants of delisting risk in the IPO equity market. After reviewing this literature, several notes are highlighted. More specifically, prior studies on delisting risk are more recent and concentrated in the U.S market compared with bankruptcy and financial distress studies, and with IPO returns studies. There is also lack of

empirical evidence on the determinants of delisting risk in Egypt, although studying delisting event in Egypt is very important as elaborated in the first chapter. Additionally, prior related studies ignore some new variables that are hypothesized to be significantly related to delisting risk such as firm type, institutional ownership and listing variables. They also show some mixed results and ignore utilizing probit and Cox non-proportional hazards models, despite their appropriateness in fitting the data of such study. Furthermore, there are some setbacks in some prior related studies that are avoided in the present study.

After discussing literature review related to delisting risk in the IPO market, the next chapter discusses research methods adopted in this study.

CHAPTER 4

RESEARCH METHODS

4.1 INTRODUCTION

This study focuses on examining delisting risk in the Egyptian initial public offering (IPO) market. While an introduction to the study, an overview about the Egyptian Stock Exchange and IPO market, and related literature review are discussed in the first three chapters, research methods are discussed in this chapter. Delisting risk is studied from two perspectives, namely delisting rate and survival time analyses. Firms which have high delisting rate are also expected to have short survival time. In other words, it is expected that factors which affect delisting rate and survival time to be the same. Section 4.2 presents the theoretical framework, followed by a discussion of variables and hypotheses of the study in Section 4.3. The measurement of variables, and models used in the study are shown in Sections 4.4 and 4.5, respectively. Then, data collection process is discussed in Section 4.6. This chapter ends with a summary in Section 4.7.

4.2 THEORETICAL FRAMEWORK: DETERMINANTS OF DELISTING RISK

The general and detailed theoretical frameworks are presented in Figures 4.1 and 4.2, respectively, as follows:

Figure 4.1 General theoretical framework

Independent Variables

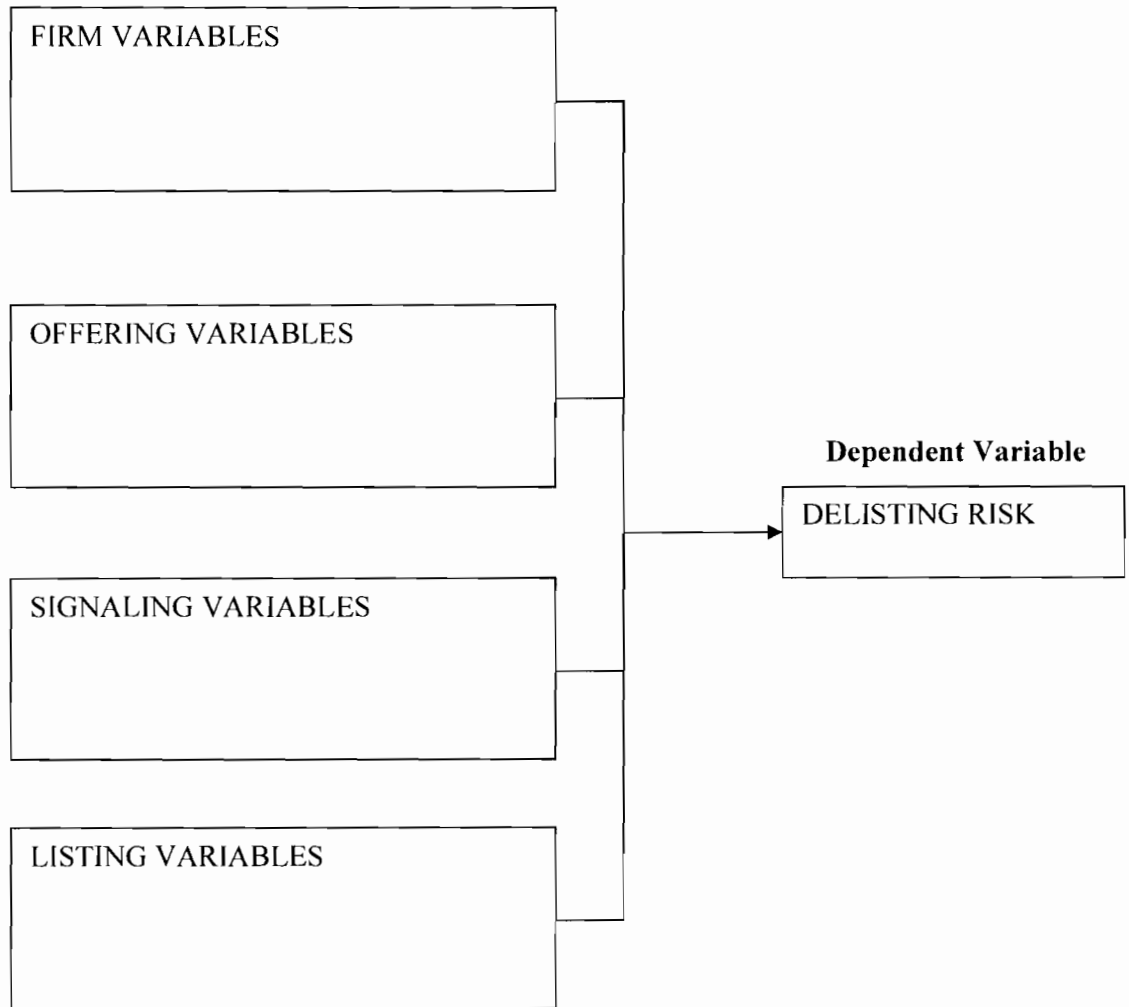
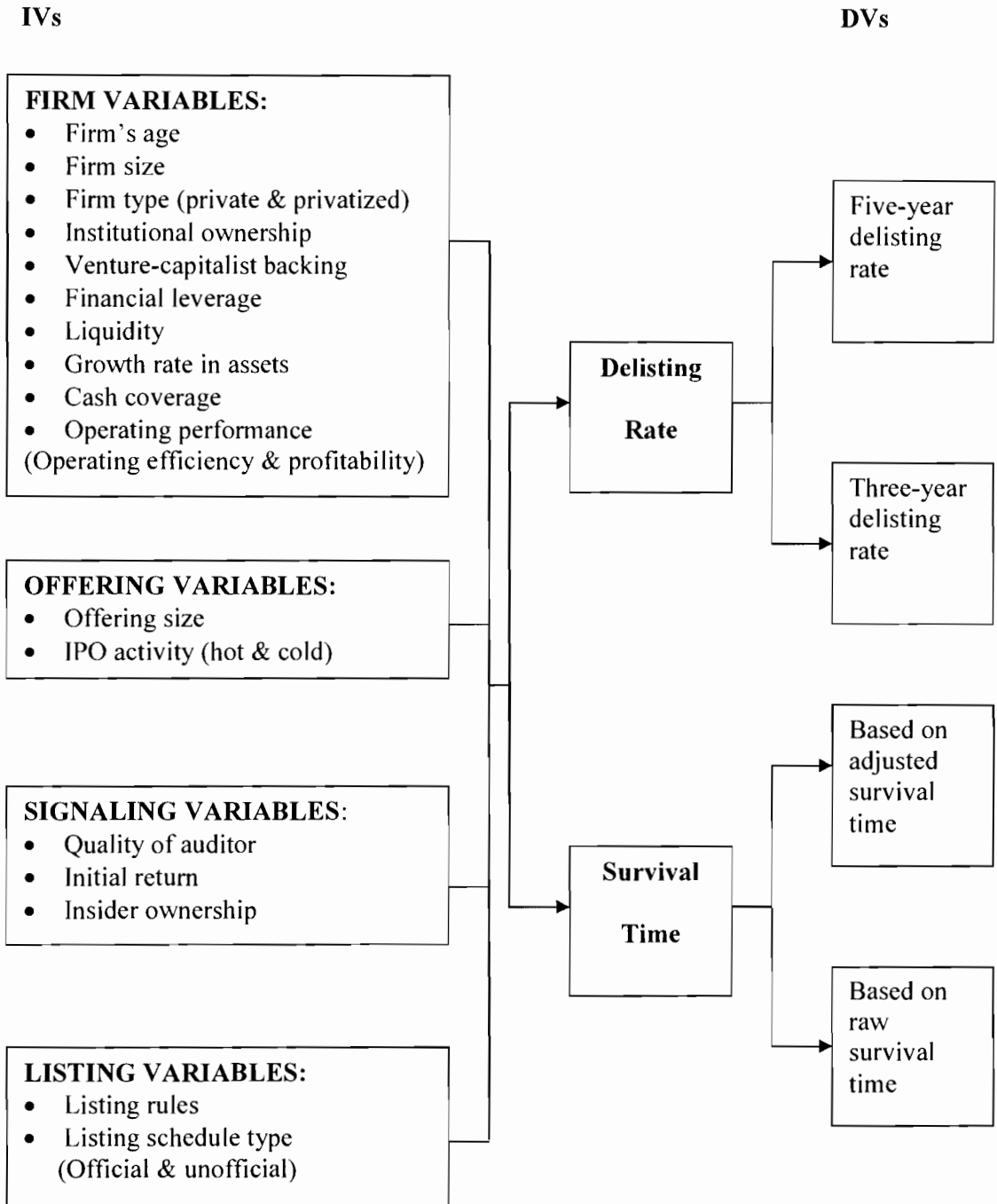


Figure 4.2 Detailed theoretical framework



4.3 VARIABLES AND HYPOTHESES

The relationship between independent variables and the dependent variable is discussed in this section. Several firm variables are included in this study. These variables include both firm demographic variables and firm performance variables. Jenkinson and Ljungqvist (2001) argue that using firm variables only as measures of risk ignores the information production that takes place in the IPO market. Therefore, this study also uses other groups of variables related to the IPO market. More specifically, four groups of independent variables are used in this study, namely firm variables, offering variables, signaling variables, and listing variables. Most data of these independent variables are obtained from IPO prospectuses. The relationship between each independent variable and delisting risk is discussed first; where high (low) delisting risk is attributed to high (low) delisting rate, short (long) survival time, or both. Then, the hypothesis that supports this relationship is developed in this section. Thus, this section includes four subsections as follows:

4.3.1 Firm Variables¹⁵

I) Firm demographic variables

a) Firm's age

Ritter (1984, 1991) argues that firm's age is a negative proxy for risk because more established firms are easier to be valued due to the availability of their information. In addition, Hensler et al. (1997) claim that young firms at the IPO date may be more speculative than old ones. Further, Jain and Kini (1999b), and

¹⁵ The researcher together with his supervisors presented a paper in the 7th annual AGBA Congress conference to test the relationship between firm variables and delisting risk in the Egyptian IPO market (Algebaly, Ibrahim, & Ahmad-Zaluki, 2010).

Lamberto and Rath (2010) argue that firms which offer IPOs too early in their life are more likely to suffer from failure risk because they are unproven in business environment. Esteve-Pérez and Mañez-Castillejo (2008) employ the resource-based theory to argue that the survival profile is worse in younger firms due to the lack of their unique resources. Thus, younger firms are more likely to be delisted involuntarily. These firms are also more likely to survive short time after the offering date.

The expected negative relationship between firm's age and delisting rate is supported empirically by Schultz (1993), Peristiani and Hong (2004), Li et al. (2006), Demers and Joos (2007), and Yung et al. (2008). In addition, survival time increases significantly with the increase in firm's age based on the studies of Hensler et al. (1997), Jain and Martin Jr (2005), Li et al. (2006), and Yang and Sheu (2006). Therefore, it is hypothesized that:

H1₁: There is a significant negative relationship between firm's age and delisting risk.

b) Firm size

In regard to firm size, Beaver, Ketter and Scholes (1970), Bhabra and Pettway (2003), and Abdelghany (2005) argue that larger firms have less risk because they are usually more diversified in terms of individual business assets and are better monitored by informed investors. They also have better access to investment capital and have higher operating performance (Alvarez & Gonzalez, 2005). Based on the resource-based theory, smaller firms have not enough resources to recover from mistakes in investment strategy. In addition, it is difficult for them to

recruit qualified workers and managers who may assist in improving the survival profile of their firms (Esteve-Pérez & Mañez-Castillejo, 2008). Thus, smaller firms are expected to have more delisting risk.

Schultz (1993), Baker and Kennedy (2002), Bhabra and Pettway (2003), Peristiani (2003), Li et al. (2006), Charitou et al. (2007), Demers and Joos (2007), and Yung et al. (2008) report a significant negative relationship between firm size and delisting rate. Additionally, Li et al. (2006), among others, find that firm size associates positively with survival time. Therefore, this hypothesis is developed:

H1₂: There is a significant negative relationship between firm size and delisting risk.

c) Firm type

At the time of the IPO, there are two types of firms, namely privately-owned firms and the state-owned enterprises (SOEs). Privatized SOEs are often larger, older, well known, and have more stable earnings when compared with most privately-owned firms. In line with the resource-based theory, privatized firms may have unique resources that are not available to private firms. In addition, governments often offer the most profitable enterprises as privatization IPOs (PIPOs) to get the support of the privatization program and to attract investors in the following offers (Jelic & Briston, 2003). Furthermore, governments may have the tendency to protect PIPO firms from delisting to prove the success of their privatization programs (Ferris, Jayaraman, & Sabherwal, 2007).

Thus, it could be inferred that PIPO firms are less likely to be delisted in comparison to privately-owned IPOs. Menyah et al. (1995), Durukan (2002), Jelic

and Briston (2003), and Peter (2007) find empirical support for the significant overperformance of PIPOs compared with their counterparts in private IPOs. Moreover, Huang and Song (2005) report a better operating performance in privatization IPOs, measured by return on equity, compared with private IPOs. Therefore, the next hypothesis is as follows:

H1₃: Privatization IPO firms have significantly less delisting risk compared with privately-owned IPO firms.

d) Institutional ownership

The theoretical and empirical evidences on the relationship between institutional ownership and firm performance show mixed results. The monitoring role of institutional investors may improve the corporate governance mechanisms and ameliorate firm performance accordingly (Balatbat et al., 2004). This argument is in accordance with the efficient monitoring hypothesis of Pound (1988). Furthermore, institutional investors are generally more rational than individual ones. Thus, they are less exposed to noise trading and usually avoid investing in high risky firms (Sias, 1996). Potter (1992) finds that institutional investors prefer investing in large firms. Since firm size is a negative proxy for firm's risk, a negative relationship is concluded between institutional ownership and delisting risk.

The empirical studies of Sun and Tong (2002), and Balatbat et al. (2004), among others, support the positive relationship between institutional ownership and IPOs' operating performance. Since firms with high operating performance are expected to have less delisting risk, a negative relationship is expected between institutional ownership and delisting risk. In addition, Campbell et al. (2008), among

others, report a significant negative association between institutional ownership and financial distress risk.

On the other hand, institutional investors may not monitor managements' actions effectively because the costs of monitoring may exceed its benefits (Balatbat et al., 2004) or due to the mutually advantageous relationships with managers, as stated by the conflict of interest and strategic alignment hypotheses of Pound (1988). Cai and Wei (1997) find insignificant association between institutional ownership and long-run IPO returns. In addition, the studies of Kumar (2005), and Ming and Gee (2008), among others, report that the impact of institutional ownership on firm performance is not significant. In a nutshell, prior empirical and theoretical evidences regarding the relationship between the degree of institutional ownership and risk are not conclusive. Therefore, this non-directional hypothesis is developed:

H1₄: There is a significant relationship between the proportion of institutional ownership and delisting risk.

e) Venture capital (VC) backing

Venture-capitalists (VCs) can be defined as active long-term investors who try to add value to their firms through continuing business development (Jain & Kini, 1995). They play two leading roles in the IPO process, namely the certification and monitoring roles. VCs are induced to perform these two roles effectively in order to protect their reputation and monetary capital (Dolvin & Pyles, 2006; Jain & Kini, 1995, 2000). Thus, the participation of VCs is regarded as an indicator of firm's quality. The certification role of VCs certifies that offer prices reflect all relevant information about the IPO firm; as argued by the certification hypothesis (Megginson

& Weiss, 1991). Thus, this role is related to the short run. The monitoring role, however, is associated with the long-run. Success in the monitoring role leads to improving firm performance.

There are several ways by which VCs take part in the success of IPO firms. VCs supply IPO firms with the required finance, prepare them to go public, and guide them in the first years after the IPO. The finance introduced by VCs is provided in stages. This staged finance reduces agency cost by forcing managers to avoid investing in non-value maximizing activities. The staged finance also enables VCs to depart from firms that perform poorly, with minimum losses (Jain & Kini, 1995). In addition, VCs specialize in certain industries, so they have sufficient experience and therefore can advise the management of their firms well in some areas such as engaging in strategic planning, forming human resource policies, and helping in the production and operations decisions (Jain & Kini, 1995, 2000; Kooli & Meknassi, 2007; Jain, Jayaraman, & Kini, 2008).

VCs also monitor managers' actions effectively and often take membership in the board of directors. They help in designing compensation schemes that secure the effectiveness of the firm. So, the agency cost is expected to be less in their firms. In addition, VC backed firms can easily attract reputable underwriters, institutional investors, and analysts to guarantee the success of their firms in the IPO process (Jain & Kini, 1995, 2000).

The empirical evidence of Jain and Kini (2000), Li et al. (2006), and Kooli and Meknassi (2007) confirm that VC participation enhances the survival profile of

their firms. Moreover, Li et al. (2006), Kooli and Meknassi (2007) and Yung et al. (2008) report that delisting rate is significantly less in the VC backed firms. Based on the previous theoretical and empirical arguments, the presence of VCs is expected to reduce delisting risk. Thus, this hypothesis is developed:

H1₅: IPO firms backed by VCs have significantly less delisting risk compared with non-VC backed firms.

II) Firm performance variables

a) Financial leverage

The trade-off theory of capital structure argues that financial distress increases with the increase in leverage (Lamberto & Rath, 2010). Since bankruptcy is one reason for involuntary delisting, high levered firms are more expected to suffer from delisting risk. The positive relationship between financial leverage and delisting rate is confirmed by many authors (e.g., Platt, 1995; Baker & Kennedy, 2002; Li et al., 2006; Demers & Joos, 2007; Yung et al., 2008). In addition, Li et al. (2006), find a significant negative relationship between financial leverage and survival time. Therefore, this hypothesis is developed:

H1₆: There is a significant positive relationship between financial leverage and delisting risk.

b) Liquidity

High liquidity position prevents the firm from any unexpected financial problems (Beaver et al., 1970; Abdelghany, 2005). In addition, liquidity can be considered as a measure of efficiency. This is because high liquid firms are expected

to utilize their assets efficiently to avoid bankruptcy or financial distress. Consequently, the survivability of these firms will enhance (Lamberto & Rath, 2010). Based on the perspective of the resource-based theory, high liquid firms are expected to survive longer because they have more resources than other firms. Thus, delisting risk should be negatively associated with liquidity. Platt (1995), Willenborg and McKeown (2001), and Peristiani (2003) confirm the negative relationship between liquidity and delisting rate. Furthermore, Goot et al. (2009) report a significant positive association between liquidity, measured by cash flow over liabilities, and survival time. Therefore, the next hypothesis is:

H1₇: There is a significant negative relationship between liquidity and delisting risk.

c) Growth rate in total assets

The relationship between growth rate in total assets and delisting risk could be justified by two conflict arguments. On the one hand, Beaver et al. (1970), Farrelly, Ferris and Reichenstein (1985), and Abdelghany (2005), among others, argue that firms with lower payout ratios are expected to have higher growth rates. These firms are also associated with higher risk because they are not certain about their future. Therefore, a positive relationship is expected between assets growth rate and delisting risk. Fama and French (2004) support the positive relationship between the growth rate in total assets and delisting rate.

On the other hand, a firm with high assets growth rate is expected to have high level of total assets, which is a measure of firm size. Since firm size is a negative proxy for firm's risk, a negative relationship is expected between assets

growth rate and delisting risk. In addition, firms with high growth rate are expected to have high profitability to finance their purchases of assets. These firms are also expected to survive longer because they may have unique resources compared with other firms; as expected by the resource-based theory. Thus, the survivability of firms with high assets growth rate may be better than other firms because profitability is considered as an indicator of firm's quality. Demers and Joos (2007) find significant inverse association between growth rate in profit margin and delisting rate. In addition, Li et al. (2006) find a significant negative relationship between income growth rate and delisting risk. Therefore, the next hypothesis is non-directional as follows:

H1₈: There is a significant relationship between growth rate in total assets and delisting risk.

d) Cash coverage

Coverage ratios are measures for financial risk. These ratios measure the ability of firm's earnings or cash flows to cover its fixed obligations (Reilly & Brown, 2006). Consequently, coverage ratios are expected to be inversely related to delisting risk. Based on the perspective of the resource-based theory, firms with high coverage are expected to have better performance and to survive longer than other firms because they are expected to have more unique resources compared with other firms. Platt (1995) reports a significant positive relationship between interest to cash ratio and delisting rate. Interest to cash ratio is an inverse measure of coverage. In other words, Platt (1995) finds that delisting rate decreases significantly with the increase in cash to interest ratio. Cash coverage ratio is used in this study as a measure of coverage. Therefore, this hypothesis needs to be tested:

H1₉: There is a significant negative relationship between cash coverage ratio and delisting risk.

e) Operating performance

Operating performance, as a firm performance variable, includes firm's efficiency in utilizing its assets (operating efficiency) and its ability to generate profits from its sales or capital employed (operating profitability) (Reilly & Brown, 2006). High quality firms are expected to have high historical earnings (Teoh, Welch, & Wong, 1998; Brau & Fwsett, 2006). Thus, operating performance can be considered as an indicator of firm's quality. That is, the higher the profitability and efficiency of a firm, the lower the probability of its failure (Logue & Merville, 1972; Demers & Joos, 2007). In addition, firms with high operating performance are expected to survive longer than other firms because operating efficiency and profits may provide the necessary resources used in innovation and advertising activities; as predicted by the resource-based theory (Esteve-Pérez & Mañez-Castillejo, 2008). Thus, firms with better operating performance are expected to have less delisting risk compared with other firms.

Several authors studied the relationship between profitability and delisting risk. For example, Jain and Kini (1999b), Willenborg and McKeown (2001), Baker and Kennedy (2002), Wilbon (2002), Bhabra and Pettway (2003), Peristiani and Hong (2004), and Charitou et al. (2007) report that delisting rate decreases significantly in high profitable firms. In a more recent study, Jain and Kini (2008) find a positive significant relationship between operating return on assets and survival time. Nevertheless, there is lack of studies concerning the relationship

between operating efficiency and delisting risk (e.g., Peristiani, 2003; Goot et al., 2009; Lamberto & Rath, 2010). The effect of both operating efficiency and operating profitability on delisting risk is studied in the present study. Thus, the following hypothesis is:

H1₁₀: There is a significant negative relationship between operating performance (operating efficiency and profitability) and delisting risk.

Based on the previously mentioned arguments concerning firm variables, the first main hypothesis is developed as follows:

H1: There is significant relationship between firm variables and delisting risk.

4.3.2 Offering Variables

a) Offering size

Beatty and Ritter (1986) argue that smaller IPOs are more speculative than larger ones. In addition, IPO firms that issue large offerings are expected to have better performance because they have less uncertainty about their future (Jain and Kini, 2000). Furthermore, Boubakri et al. (2005), and Kooli and Meknassi (2007) argue that the relationship between offering size and the need to obtain additional capital in the future is negative. That is, firms with high offering size are less expected to suffer from financing problems. Based on the perspective of the resource-based theory, firms with higher offering size are expected to survive longer because they are expected to have the required resources for innovation and advertising activities.

Moreover, Lamberto and Rath (2010) claim that offering size is an indicator for market confidence. Hence, larger offerings; which are often associated with larger firms, are subject to high monitoring from the capital market, and are favored by institutional investors. Thus, small issuers are more likely to suffer from financial difficulties and involuntary delisting. The studies of Hensler et al. (1997), Jain and Martin Jr (2005), Kooli and Mekkassi (2007), Jain and Kini (2008), and Lamberto and Rath (2010) report that the larger the offering size, the better the survival profile of an IPO firm. In addition, Jain and Kini (1999b), Willenborg and McKeown (2001), Bhabra and Pettway (2003), Boubakri et al. (2005), and Kooli and Mekkassi (2007) find a significant negative relationship between offering size and delisting rate. Therefore, the next hypothesis is as follows:

H2₁: There is a significant negative relationship between offering size and delisting risk.

b) IPO activity

Based on the theoretical explanation of the "window of opportunity hypothesis" of Ritter (1984, 1991) and Loughran and Ritter (1995) presented in Chapter 3, IPO is issued either in hot-issue periods or in cold-issue ones. Hot-issue periods are the periods within which large numbers of IPOs are issued. Consequently, investors' overoptimism is existed in hot-issue periods. Many poor performing firms enter the IPO market in hot-issue periods to benefit from investors' overoptimism. Consequently, IPO firms that go public during hot periods are expected to have high magnitude of delisting risk.

The expected positive relationship between IPO activity and delisting rate is supported by Boubakri et al. (2005), Demers and Joos (2007), Kooli and Mekkassi (2007), and Yung et al. (2008). In addition, Boubakri et al. (2005) and Kooli and Mekkassi (2008) report that the survival profile of IPOs deteriorates significantly for shares issued during the hot issue periods. Therefore, the next hypothesis is developed as follows:

H2₂: Firms issuing IPOs in hot-issue periods have significantly more delisting risk compared with those issuing IPOs in cold-issue periods.

Based on the previous discussion of offering variables, the second main hypothesis is developed as follows:

H2: There is significant relationship between offering variables and delisting risk.

4.3.3 Signaling Variables

Reputation of underwriter, quality of auditor, initial return, and insider ownership variables can be considered as positive signals of the firm's quality. Thus, these variables could be used as signaling variables in the present study. The theoretical explanations of the relationship between signaling variables and delisting risk are obtained from both the certification and signaling hypotheses detailed in Chapter 3.

According to the certification hypothesis, the third party certification can be viewed as a solution to the information asymmetry problem between corporate insiders and public owners. The involvement of the third party in the IPO process

certifies that offer price reflects all relevant information because this third party needs to protect his reputation (Carter & Manaster, 1990; Megginson & Weiss, 1991; Jain & Kini, 1995, 1999a; Dolvin & Pyles, 2006; Jain et al., 2008). This third party may be reputable underwriters, venture capitalists, or high quality auditors. In addition to the certification role of the third party at the offering date, a better performance is expected due to the monitoring and advising roles of the third party after the offering date (Jain et al., 2008). Furthermore, high quality firms may signal their quality by relying on reputable underwriters, hiring high quality auditors, underpricing their IPOs, and/or retaining high proportion of shares through their insiders. As such, a negative relationship is expected between these signaling variables and delisting risk.

a) Quality of auditor

Auditor's quality and underwriter's reputation variables can be considered as substitute signals regarding firm's quality (Jain & Martin Jr, 2005). In other words, it is sufficient to study either auditor's quality or underwriter's reputation variables. In this study, only auditor's quality variable is examined as a potential explanatory variable of delisting risk due to lack of data on underwriter's reputation.

High quality firms are expected to hire high quality auditors to signal their quality. It is not rational for low quality firms to follow the high quality ones in assigning high quality auditors. This is because most low quality firms can not bear the high costs of hiring high quality auditors. In addition, low quality firms will be under the severe monitoring of reputable auditors. This will ban them from using earnings management to increase investors' valuation regarding their offerings. The

monitoring of high quality auditors is expected to be stricter than that of low quality ones in order to maintain their reputation and to avoid the lawsuits by investors. In the U.S, Section 11 of the SEC ACT in 1933 states that underwriters and auditors who sign the registration statement are legally responsible for any false, fraudulent, or omission of significant information (Jain & Martin Jr, 2005). Demers and Joos (2007) report a significant lower delisting rate in high technology firms which employ high quality auditors. Jain and Martin Jr (2005) also find that auditor's quality enhances the survival profile of IPO firms. Therefore, this hypothesis is developed as follows:

H3₁: There is a significant negative relationship between the quality of auditor at the IPO time and delisting risk.

b) Initial return

Several prior studies (e.g., Tiniç, 1988; Clarkson & Merkley, 1994; How, 2000; Dimovski & Brooks, 2004; Doeswijk, Hemmes, & Venekamp, 2006) use "initial return" and "underpricing" interchangeably. Based on the theoretical explanations of the signaling hypotheses of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989), underpricing is considered a signal of firm's quality. It can also be considered as a means for firm's publicity according to the marketing event hypothesis of Chemmanur (1993) and Demers and Lewellen (2003), as detailed in Chapter 3. The studies of Schultz (1993), Peristiani (2003), Boubakri et al. (2005), Demers and Joos (2007), and Yung et al. (2008) find that delisting rate decreases significantly in firms with high initial returns. In addition, Hensler et al. (1997) and Boubakri et al. (2005) report a significant positive association between initial returns of IPOs and survival time. Therefore, this hypothesis is developed:

H3₂: There is a significant negative relationship between initial return and delisting risk.

c) Insider ownership

The signaling hypothesis of Leland and Pyle (1977), and Grinblatt and Hwang (1989), examined in Chapter 3, claims that insider ownership provides a positive signal of firm's quality. Thus, higher insider ownership holding should be associated with lower delisting risk. In addition, Jensen and Meckling (1976), in their interest convergence theory, argue that agency costs will reduce with the high percentage of insider ownership. This is because high insider ownership will stimulate original owners to use IPO proceeds in activities that maximize firm value; which will increase the survivability of IPO firm accordingly. Peristiani and Hong (2004) find a significant negative relationship between insider ownership and delisting rate. Furthermore, Hensler et al. (1997), Jain and Kini (2000, 2008) and Goot et al. (2009) report a significant longer survival time in firms that maintain high percentage of insider ownership. Therefore, the previous arguments are translated in hypothesis form as follows:

H3₃: There is a significant negative relationship between the proportion of insider ownership and delisting risk.

Based on the previous discussion on signaling variables, this main hypothesis is developed as follows:

H3: There is significant relationship between signaling variables and delisting risk.

4.3.4 Listing Variables

a) Listing rules

Listing rules variable is extracted from the Egyptian context. To detail, the EGX updated its listing rules on August 2002, as discussed in chapter 2. These new listing rules are applicable on all firms listed on August 2002 onwards. On September 2003, the new rules are also enforced on firms listed before August 2002. The new listing rules are stricter than old ones (Berg & Miarta, 2004). Moreover, the amount and quality of disclosure have greatly improved in the EGX after updating the new rules. Several publications are released by the EGX, continuous updating in the EGX website is implemented, and automated disclosure information system is used. This is due to the positive role played by the disclosure department, fining non-compliant issuers, and the incorporation of investor relations and corporate governance committee (Abdel Shahid, 2003).

The new listing rules regulation issued on August 2002 resulted in the real involuntary delisting of bad firms. That is, this regulation increased the probability of involuntary delisting of bad firms. Therefore, the question is which firms are more expected to expose to involuntary delisting, firms listed before August 2002 or those listed on or after that date? The researcher expects that delisting risk will be higher in firms listed on August 2002 onwards compared to firms listed before that date. This expectation is attributed to the two factors responsible for the re-emergence of the EGX, explained in Chapter 2, namely the Capital Market Law No. 95 for the year of 1992, and the Egyptian privatization program, which started in 1994.

More specifically, the capital market law encouraged good firms to go public through IPOs. Thus, good IPOs were concentrated shortly after the year of 1992; especially over the period of 1994-1999. The Egyptian privatization program is also concentrated in these hot periods (Ministry of Investment; Ministry of Trade and Industry, monthly economic bulletin, march 2005). Privatization IPOs are often larger, older, well known, and have more resources when compared with most privately-owned firms. Thus, these firms are expected to survive longer than other firms as discussed earlier in firm type variable. This expectation is also consistent with the resource-based theory. Based on these arguments, the following hypothesis is developed:

H4₁: Delisting risk is significantly higher in firms listed on August 2002 onwards relative to those listed before that date.

b) Listing schedule type

Listing type variable is included in some IPO studies (such as Ahmad-Zaluki et al., 2007) as a potential determinant for long-run stock returns. According to Article 16 of the Egyptian Capital Market Law 95/1992, there are two main schedules for listing in Egypt. The first one is called the Official Schedule, while the second one is known as the Unofficial Schedule. In general, the Official Schedule is dedicated to large and old firms. The Unofficial Schedule, however, is suitable for small and young firms. The long-run performance is expected to be better in large and old firms because they usually have the required resources to improve their performance and to lengthen their survival time; as hypothesized by the resource-based theory (Esteve-Pérez & Mañez-Castillejo, 2008). Therefore, firms listed on the Official Schedule are expected to have less delisting risk relative to those listed on

the Unofficial Schedule. As a result, listing schedules type variable, derived from the Egyptian context, is employed as a potential determinant for delisting risk. Thus, this hypothesis is developed:

H4₂: Firms listed on the Official Schedule have significantly less delisting risk relative to those listed on the Unofficial Schedule.

Based on the previously mentioned arguments regarding listing variables, the fourth main hypothesis is developed as follows:

H4: There is significant relationship between listing variables and delisting risk.

4.4 MEASUREMENT OF VARIABLES

Measurement of variables is discussed in two subsections, namely Section 4.4.1 which includes measurement of the dependent variable, and Section 4.4.2 which discusses the measurement of the independent variables as follows:

4.4.1 Measurement of the Dependent Variable (Delisting Risk)

Delisting risk is the dependent variable employed in this study. It is measured by delisting rate and survival time as follows:

a) Survival time

The common definition of survival time; referred to in this study as the raw survival time, is the period from listing date to involuntary delisting date; known as listing period (Boubakri et al., 2005; Kooli & Mekkassi, 2007). However, this definition is not relevant to the Egyptian context because it ignores the enforcement

date of the new Egyptian listing rules, which allowed the real involuntary delisting of bad firms, issued on August 2002. These new rules are applied on all firms listed on August 2002 onwards. Thus, the researcher computes the survival time of firms listed on August 2002 onwards as the listing period. Furthermore, the new listing rules are applied on September 2003 on firms listed before August 2002, after one-year grace period. Thus, this study computes the survival time of firms listed before August 2002 as the difference between involuntary delisting date and September 2003¹⁶.

Therefore, the adjusted survival time is defined in this study as the difference between the involuntary delisting date and either the listing or enforcement date, whichever comes later. It is employed in the present study because it is more realistic than the raw survival time. The adoption of this definition resulted in larger number of delisted firms relative to the number obtained from using raw survival time; as detailed in Section 4.6. Nevertheless, raw survival time is also used to check the robustness of results.

b) Delisting rate

Delisting rate is defined as the likelihood of involuntary delisting during a predetermined survival time, usually three or five survival years (Li et al., 2006). Several authors (e.g., Willenborg & McKeown, 2001; Bhabra & Pettway, 2003; Peristiani, 2003; Li et al., 2006; Charitou et al., 2007; Demers and Joos, 2007; Yung et al., 2008) measure involuntary delisting rate by a dummy variable. Thus, the researcher measures it by a dummy variable having a value of "1" if the firm was delisted within three or five survival years, and "0" otherwise.

¹⁶ The earliest involuntary delisting date in this study is on 27 May 2004. Thus, there are no cases of involuntary delisting before September 2003 in the firms' samples used in this study.

4.4.2 Measurement of Independent Variables

4.4.2.1 Firm Variables

I) Firm demographic variables

a) Firm's age

Several prior studies (e.g., Ritter, 1984, 1991; Megginson & Weiss, 1991; Schultz, 1993; Hensler et al., 1997; Lin & Smith, 1998; How, 2000; Habib & Ljungqvist, 2001; Bhabra & Pettway, 2003; Peristiani, 2003; Abdullah & Taufil-Mohd, 2004; Boubakri et al., 2005; Yang & Sheu, 2006; Demers & Joos, 2007) define firm's age as "the period from incorporation to the offering date". This measure of firm's age is adopted in this study. Specifically, it is defined as the number of months from incorporation to the offering date.

b) Firm size

Market capitalization, defined as the number of shares listed multiplied by closing price on the first trading day, is used as a proxy for firm size in several studies (e.g., Aggarwal & Rao, 1990; Davis et al., 2000; Brounen & Eichholtz, 2002; Xu & Malkiel, 2003; Abdullah & Taufil-Mohd, 2004; Kaur, 2004; Gaspar & Massa, 2006; Li et al., 2006; Demers & Joos, 2007). Kaur (2004) argues that market capitalization is preferred to other measures of firm size such as the paid up share equity capital, net worth, total sales, and total assets since it does not depend on historical values to measure firm size. It values all firms, whether old or new, using current market prices instead. This provides a uniform basis to compare firms.

Ahmad-Zaluki et al. (2007), among others, use real market capitalization at the time of listing instead of nominal market capitalization. Real market capitalization is the nominal market capitalization adjusted for inflation risk using the consumer price index (CPI). However, it is common to use firm size variable in the natural logarithmic form (Willenborg & McKeown, 2001; Li et al., 2006; Yung et al., 2008; Goot et al., 2009). Therefore, the natural log of the real market capitalization is employed in this study to measure firm size.

c) Firm type

Firm type is segmented into private firms and state-owned privatized firms. Following the studies of Durukan (2002), Sun and Tong (2002), and Alvarez and Gonzalez (2005), a dummy variable is used in the present study to measure firm type variable. It has a value of "1" if the firm is a privatized firm and "0" if it is a privately-owned one.

d) Institutional ownership

Institutional ownership concentration is measured by many authors (e.g., Potter, 1992; Sias, 1996; Xu & Malkiel, 2003; Gaspar & Massa, 2006) as the number of shares owned by institutional owners divided by the number of shares outstanding. Therefore, this measure is employed in this study.

e) Venture-capital (VC) backing

A dummy variable for whether the issue has VC backing is employed by many authors (e.g., Jain & Kini, 1995, 1999b, 2000; Boubakri et al., 2005; Demers & Joos,

2007; Kooli & Meknassi, 2007; Jain et al., 2008; Yung et al., 2008). Appendix 5 shows venture capital firms operating in the Egyptian market. Thus, this study uses a dummy variable with a value of "1" if the IPO firm is backed by one or more firms shown in Appendix 5, and "0" otherwise.

II) Firm performance variables

The median of each individual variable in this category is computed over three-year time period before going public or over the period from firm's incorporation to the offering date, whichever is less. This period is chosen because Article 5 of the Egyptian Capital Market Law No. 95/1992 mandates IPO firms to disclose their financial statements in the prospectus for the last three years, or from the date of firm's incorporation, whichever is less. Using median is preferred to mean and to yearly data because it eliminates the impact of temporal fluctuations attributed to either accrual accounting or due to earnings management (Jain & Kini, 1999a). This group contains the following variables:

a) Financial leverage

Financial leverage indicate the extent to which firm depends on debts in finance. Debts increase returns to shareholders in good times and reduce them in bad times. Consequently, it is said that debts create financial leverage (Brealey et al., 2001). Many Authors (e.g., Li et al., 2006; Charitou et al., 2007; Yung et al., 2008) use total debts ratio to measure financial leverage. Therefore, this ratio is used in this study.

b) Liquidity

The ability of an asset to be converted to cash quickly at low cost is measured by liquidity ratios (Brealey et al., 2001). Several authors measure liquidity by current ratio because of its popularity (e.g., Shumway, 2001; Chava & Jarrow, 2004; Abdelghany, 2005; Abdullah, Halim, Ahmad, & Md Rus, 2008). Current ratio is considered as a measure of both liquidity and default risk. In other words, high current ratio means high liquidity and low default risk. Thus, liquidity is measured by current ratio in the present study.

c) Growth rate in total assets

Assets growth rate is used to capture the effect of changing operating leverage (Chen, 1982). The present study measures it by the arithmetic average of assets growth rate over three-year time period before going public (Cooper, Gulen, & Schill, 2008).

d) Coverage

Coverage ratios are considered as measures for financial risk because high coverage ratios indicate lower financial risk. Interest coverage ratio indicates the extent to which interests are covered by earnings. It equals earnings before interest and taxes (EBIT) divided by interest payments. Nevertheless, it might be more important to calculate the extent to which interest is covered by the cash flow from operations, rather than by earnings. This is measured by the cash coverage ratio, which equals EBIT plus depreciation divided by interest payments.

Depreciation is not necessarily a cash outlay expense in the year it is recorded in, so it is not preferred to treat it as a cash expense. Since cash flow from operations excludes depreciation from expenses, it is preferred to use it instead of earnings (Brealey et al., 2001; Reilly & Brown, 2006). Therefore, cash coverage ratio is the measure of coverage employed in the present study.

e) Operating efficiency

Consistent with Altman (1968), Shumway (2001), Peristiani (2003), Chava and Jarrow (2004), among others, total assets turnover ratio is used to measure operating efficiency. This ratio indicates how efficiently the firm is utilizing its total assets.

f) Profitability

Profitability ratios measure the profits as a percentage of sales, assets or capital employed (Reilly & Brown, 2006). Return on equity (ROE) is used to measure profitability in this study. Many authors (e.g., D'Souza & Megginson, 1999; Dewenter & Malatesta, 2001; Wilbon, 2002; Pastor & Veronesi, 2003; Alvarez & Gonzalez, 2005; Wei & Zhang, 2006) use this ratio to measure profitability. ROE is chosen because it is a comprehensive profitability measure for evaluating the effectiveness of firm performance. It measures the profitability of both investment and finance decisions (Quiry, Dallochio, Le Fur, & Salvi, 2005).

4.4.2.2 Offering Variables

a) Offering size

Several prior studies employ offer gross proceeds to measure offering size (e.g., Habib & Ljungqvist, 2001; Bhabra & Pettway, 2003; Kooli & Suret, 2004;

Yang & Sheu, 2006; Ahmad-Zaluki et al., 2007). Ahmad-Zaluki et al. (2007), among others, use real gross proceeds adjusted for inflation rate by the CPI to measure offering size. In addition, some researchers use offering size variable in the natural logarithmic form, such as Jain and Kini (2000), Jain and Martin Jr (2005). Therefore, the natural log of real gross proceeds is used in this study to measure offering size variable.

b) IPO activity

IPO activity variable is used by Kooli and Suret (2004), Boubakri et al. (2005), and Jaskiewicz, González. Menéndez and Schiereck (2005), among others. They employ a dummy variable taking a value of "1" for hot-issue periods, and "0" otherwise. Thus, their measure is used in the present study. Jaskiewicz et al. (2005) define hot-issue periods as the periods which have IPOs above the average number of IPOs over the period of study. It is preferred, however, to use median rather than average because it is not affected by outliers (Jain & Kini, 2004). Consequently, hot-issue periods are defined in this study as the years which have number of IPOs above the median number of IPOs over the period of study.

The total number of the Egyptian IPO firms over the period of 1992-2009 is 352 firms with median value of 15 firms. Therefore, IPO activity dummy variable takes a value of "1" if the IPO firm is issued in a year that have total number of IPOs greater than 15, namely 1994, 1995, 1996, 1997, 1998, 1999, 2001, 2002, or 2006. It takes, however, a value of "0" if it is issued in the year of 1992, 1993, 2000, 2003, 2004, 2005, 2007, 2008, or 2009 which have total number of IPOs less than 15 firms.

4.4.2.3 Signaling Variables

a) Quality of auditors

To measure auditor's quality, a dummy variable is used with a value of "1" if the auditor is designated as high quality and "0" otherwise. This measure is used by Clarkson and Merkley (1994), Jain and Martin Jr (2005), and Demers and Joos (2007), among others. Table 4.1 shows the big auditors in Egypt over the period of study from 1992 to 2009.

Table 4.1 The big auditors in Egypt over the period of 1992-2009

Period	Big Auditors
1992-1998	<p><u>Big Six Auditors:</u></p> <ol style="list-style-type: none"> 1. Hazem Hassan – KPMG 2. Saleh, Barsoum, Abdel Aziz & Co – Deloitte & Touche 3. Emad Ragheb – Ernst & Young 4. Price Waterhouse 5. Coopers & Lybrand 6. Arthur Andersen
1998-2002	<p><u>Big Five Auditors:</u></p> <ol style="list-style-type: none"> 1. Hazem Hassan – KPMG 2. Saleh, Barsoum, Abdel Aziz & Co – Deloitte & Touche 3. Emad Ragheb – Ernst & Young 4. Mansour & Co. – PricewaterhouseCoopers 5. Arthur Andersen <p>(After the merge of Price Waterhouse with Coopers & Lybrand forming "PricewaterhouseCoopers" in July 1998)</p>
2002-2009	<p><u>Big Four Auditors:</u></p> <ol style="list-style-type: none"> 1. Hazem Hassan – KPMG 2. Saleh, Barsoum, Abdel Aziz & Co — Deloitte & Touche 3. Emad Ragheb – Ernst & Young 4. Mansour & Co. – PricewaterhouseCoopers <p>(After the collapse of " Arthur Andersen" in August 2002)</p>

Source: The researcher based on data from Wikipedia, the free encyclopedia website: [http://en.wikipedia.org/wiki/Big_Four_\(audit_firms\)#Egypt](http://en.wikipedia.org/wiki/Big_Four_(audit_firms)#Egypt).

b) Initial return

Initial return is defined by many authors (e.g., Schultz, 1993; Hensler et al., 1997; Bhabra & Pettway, 2003; Boubakri et al., 2005; Demers & Joos, 2007; Kooli & Meknassi, 2007) as the percentage return from the offer price to the closing price on the first trading day. These authors compute initial return as follows:

$$IR_{i,t} = (P_{i,t} - P_{i,0})/P_{i,0} \quad (4-1)$$

where $IR_{i,t}$ is the raw initial return of stock i on the first trading day t , $P_{i,t}$ is the closing price of stock i on the first trading day t , and $P_{i,0}$ is the offer price of stock i in the offering date.

The previous method of calculating initial return is not adjusted by market return. Therefore, some authors (e.g., Finn & Higham, 1988; Ritter, 1991; Aussenegg, 2000; Hegazy, 2001; Howton, Howton, & Olson, 2001; Brounen & Eichholtz, 2002; Jelic & Briston, 2003; Drobetz, Kammermann, & Wälchli, 2005; Ahmad-Zaluki, 2005; Omran, 2005; Doeswijk et al., 2006) calculate market adjusted initial return as follows:

$$AIR_{i,t} = [(P_{i,t} - P_{i,0})/P_{i,0}] - [(I_t - I_0)/I_0] \quad (4-2)$$

where $AIR_{i,t}$ is the market adjusted initial return, $P_{i,t}$, and $P_{i,0}$ are as mentioned in Equation 4-1, and I_t and I_0 are the corresponding levels of the Egyptian Public Index.

Both raw and market adjusted initial returns are calculated in this study.

c) Insider ownership

The post-IPO percentage of ownership retained by substantial shareholders and managers is known as Alpha. Alpha is the measure of insider ownership used in the present study. It is used as a measure of insider ownership by several researchers (e.g., Hensler et al., 1997; Jain & Kini, 1994, 1999b, 2000, 2008; Peristiani & Hong, 2004; Yang & Sheu, 2006; Goot et al., 2009).

4.4.2.4 Listing Variables

a) Listing rules

A dummy variable is used to measure listing rules variable. It has a value of "1" if a firm is listed on August 2002 onwards and "0" otherwise; where August 2002 is the date of the new Egyptian listing regulation.

b) Listing schedule type

Listing schedule type variable is measured in the present study using a dummy variable with a value of "1" if a firm is listed on the Official Schedule and "0" if it is listed on the Unofficial Schedule.

Table 4.2 summarizes the measurements of variables used in this study. It also shows the expected relationships between independent variables and delisting risk based on the theoretical and empirical evidences.

Table 4.2 Summary of measurement of variables used and their expected relationships with delisting risk

Variable	Measurement	Expected relationship with delisting risk
The Dependent Variable		
Delisting risk	<p>a) <u>Delisting rate:</u> A dummy variable having a value of "1" if the firm is delisted within three (five) years based on adjusted survival time for enforcement date, and "0" otherwise</p> <p>b) <u>Survival Time:</u> a) Involuntary delisting date – Listing date (For firms listed on August 2002 onwards). b) Involuntary delisting date – September 2003 (For firms listed before August 2002).</p>	
Independent Variables		
A. Firm Variables		
Firm's age	Number of months from incorporation to the offering date	Negative
Firm size	$\ln(\text{Real market capitalization}) = \ln(\text{Market capitalization} / \text{consumer price index (CPI)})$ where market capitalization = Number of shares listed \times closing price on the first trading day	Negative
Firm type	A dummy variable having a value of "1" if the firm is a privatized firm and "0" if the firm is a privately-owned firm	Negative in privatization IPOs
Institutional ownership	$\text{Post-IPO percentage of shares held by institutions} = \frac{\text{Number of shares owned by institutional owners}}{\text{Total number of common shares outstanding}}$	Positive or Negative
Venture-capital (VC) backing	A dummy variable with a value of "1" if the issuing firm has a venture-capital backing and "0" otherwise	Negative
Financial leverage	Total debts ratio = (Total liabilities/ Total assets) (The median over three-year period before going public)	Positive
Liquidity	Current ratio = (Current assets/ Current liabilities) (The median over three-year period before going public)	Negative
Asset growth rate	The arithmetic annual growth of firm's assets (The average over three-year period before going public)	Positive or Negative
Coverage	Cash coverage ratio = (EBIT + depreciation)/ Interest payments (The median over three-year period before going public)	Negative
Operating efficiency	Total assets turnover ratio = (Total sales/ Total assets) (The median over three-year period before going public)	Negative
Profitability	Return on equity (ROE) = Net income / Shareholders' equity (The median over three-year period before going public)	Negative
B. Offering Variables		
Offering size	$\ln(\text{Real gross proceeds}) = \ln(\text{Gross proceeds} / \text{CPI})$ where Gross proceeds = Number of shares offered \times offer price	Negative

Table 4.2 (continued) Summary of measurement of variables used and their expected relationship with delisting risk

Variable	Measurement	Expected relationship with delisting risk
IPO activity (Hot/cold)	A dummy variable with a value of "1" for hot-issue years (i.e. 1994, 1995, 1996, 1997, 1998, 1999, 2001, 2002, and 2006), and "0" otherwise	Positive
C. Signaling Variables		
Quality of auditor	A dummy variable with a value of "1" if the auditor is designated as high quality and "0" otherwise; where high quality auditors are the following big auditors: <ul style="list-style-type: none"> • Hazem Hassan – KPMG • Saleh, Barsoum, Abdel Aziz & Co – Deloitte & Touche • Emad Ragheb – Ernst & Young • Price Waterhouse • Coopers & Lybrand • Mansour & Co. – PricewaterhouseCoopers • Arthur Andersen 	Negative
Initial return	<p>a) Raw initial return: The percentage return from offer price to the first day closing price $(IR_{i,t}) = (P_{i,t} - P_{i,0})/P_{i,0}$</p> <p>b) Market adjusted initial return: The raw initial return adjusted by the corresponding return of the Egyptian Public Price Index $(AIR_{i,t}) = [(P_{i,t} - P_{i,0})/P_{i,0}] - [(I_t - I_0)/I_0]$</p>	Negative
Insider ownership	Alpha = Post-IPO percentage of shares retained by managers and substantial shareholders to the total number of shares after the offering	Negative
D. Listing variables		
Listing rules	A dummy variable with a value of "1" if a firm is listed on August 2002 onwards and "0" otherwise	Negative for firms listed before Aug. 2002
Listing schedule type (Official or unofficial)	A dummy variable with a value of "1" if firm is listed on the Official Schedule and "0" otherwise (On the listing date)	Negative for firms listed on the Official Schedule

4.5 MODELS USED IN THE STUDY

4.5.1 Univariate Analyses

4.5.1.1 Analyses Related to Delisting Rate

Several parametric and non-parametric univariate tests are employed in this study. More specifically, two-independent samples t test is the parametric test used in

this study, while Mann-Whitney U test and Chi-Square test for independence are the nonparametric tests used. The term "parametric" is derived from the word "parameter" which is a characteristic of the population. Therefore, these parametric tests have certain assumptions regarding the distribution of the population that should be fulfilled before use such as normality and homogeneity of variance. Non-parametric tests, however, do not require these assumptions, so they are also called distribution-free tests (Bryman & Cramer, 2005).

Both parametric and non-parametric tests could be used in the univariate analyses. However, the relative importance of using parametric versus non-parametric tests may be affected by violating one or more assumptions of the parametric ones. That is, parametric tests are more powerful than their counterparts of non-parametric tests if their assumptions are fulfilled. However, there is a great debate regarding the relative importance of parametric versus non-parametric tests when one or more assumptions of parametric tests are violated (Bridge & Sawilowsky, 1999; Bryman & Cramer, 2005; Leech, Barrett, Morgan, 2005).

Some statisticians believe that some parametric tests (such as t-test and ANOVA) are quite robust to the violations of one or more of their assumptions. Therefore, they support the use of parametric tests even when violating their assumptions (Bridge & Sawilowsky, 1999). Other statisticians find that non-parametric tests are more powerful than parametric ones when violating one or more assumptions of the parametric tests (Bridge & Sawilowsky, 1999; Bryman & Cramer, 2005.; Leech et al., 2005). The researcher belongs to the second school of thought. Therefore, both parametric and non-parametric tests are applied. If there are

differences between their results, the assumptions of parametric tests are reviewed. If all assumptions are fulfilled, the researcher depends only on the results of parametric tests. However, if one or more assumptions of parametric tests are violated, he relies only on the results of non-parametric tests.

4.5.1.2 Analyses Related to Survival Time

Both Life table and Kaplan-Meier methods provide useful descriptive statistics related to survival time. They could also be used to test the differences in the survival time between the groups of each categorical predictor. Unlike life table method, Kaplan-Meier method can handle censored data. Therefore, Kaplan-Meier is employed in this study in the exploratory and univariate analysis stage (Allison, 2004; SPSS Inc, 2006; Garson, 2010).

Three nonparametric Chi-Square tests are available in the Kaplan-Meier survival analysis, namely log rank test, Breslow test and Tarone-Ware test. All the three tests share the same null hypothesis that there is no difference between the survival functions of the two categories of each independent variable. Although these tests differ in the weighting scheme assigned to time points (months in this study), they often give very similar results (Marques de Sá, 2007; Garson, 2010).

The survival and hazard functions are also parts of the outputs of Kaplan-Meier analysis. The survival function ($S(t)$) is defined as the probability that the survival time of the object is at least t . However, the hazard function ($h(t)$) is the probability that the object fails at time t , given survival until that time (Marques de Sá, 2007; Garson, 2010). That is, the survival function in this study is the probability

that the IPO firm survives at least to time t , and the hazard function is the probability that the IPO firm is delisted involuntarily at time t , conditional on having survived up to that time. The category of independent variable which has higher survival function curve is expected to survive longer than the other category. In addition, the category of independent variable which has lower hazard function curve is expected to have less risk of delisting than the other category (Jain & Kini, 2000).

Log rank test (also known as Mantel-Cox test) is preferred over the two other tests if the number of censored cases is large and the two survival functions do not cross each other. Censored cases are the cases which have not reached the endpoint of interest at the completion of the study (Der & Everitt, 2007). Breslow test (also called generalized Wilcoxon test or Gehan test), however, is the test of choice if the two survival functions cross each other. Finally, Tarone-Ware test provides Chi-Square statistics between the statistics of log rank test; which usually has the largest χ^2 statistics, and Breslow test; which usually has the smallest χ^2 statistics (Landau & Everitt, 2004; Marques de Sá, 2007; Garson, 2010).

4.5.2 Multivariate Analyses

4.5.2.1 Logit and Probit Regression Models

To check the determinants of delisting risk, limited dependent variable models could be used. The term "limited" is used because the value of the dependent variable in these models is limited to certain integers. Discriminant analysis, linear probability model (LPM henceforth), and binary logit and probit regression models are considered as limited dependent variable models (Leech et al., 2005; Brooks, 2008).

In discriminant analysis, all independent variables should be quantitative (continuous). The only exception to use categorical independent variables in discriminant analysis is when the binary dependent variable is split equally. That is, each category of the dependent variable should contain the same, or nearly the same, number of observations, which is not the case in the present study (Leech et al., 2005). Therefore, this model is not suitable for the present study which contains both continuous and dummy independent variables. In addition, the dependent variable is not equally split.

LPM, and logit and probit models, however, can be used when the model contains both quantitative and dummy variables (Leech et al., 2005). LPM is the simplest model of limited dependent variable models. It assumes that the fitted value of the dependent variable is linearly related to a set of independent variables; which could contain either quantitative or dummy variables or both. Thus, OLS estimation method is used in the LPM. The main disadvantage of LPM is that it can produce estimated probabilities that are negative or greater than one; which are meaningless. Therefore, it is not preferred to use LPM as a limited dependent variable model (Leech et al., 2005; Brooks, 2008, 2009).

Both logit and probit models are preferred to the LPM. These two models depend on the maximum likelihood estimation method instead of the OLS method used in the LPM. In these two models, the LPM is transformed to ensure that the fitted values of the dependent variable fall between zero and one. While the cumulative logistic function is used in the logit model to transform the LPM, the standard normal cumulative distribution function is employed in the probit model to

achieve that goal. Because these two functions are similar, logit and probit models often give similar results (Brooks, 2008).

The involuntary delisting rate (P_i) is estimated by equations 4-3 and 4-4 based on the logit and probit models, respectively (Schultz, 1993; Wooldridge, 2006). It is common, however, to express the logit model using the log odds of the event under study as the dependent variable (Gujarati, 2003; Garson, 2010). Therefore, the logit model in this study could be expressed as illustrated in Equation 4-5.

$$P_i = \exp [b_0 + \sum_{k=1}^n b_k X_{k,i}] / (1 + \exp [b_0 + \sum_{k=1}^n b_k X_{k,i}]) \quad (4-3)$$

$$= \frac{1}{1 + \exp^{-(b_0 + \sum_{k=1}^n b_k X_{k,i})}}$$

$$P_i = (2 \pi)^{-1/2} \exp (-[b_0 + \sum_{k=1}^n b_k X_{k,i}]^2 / 2) \quad (4-4)$$

$$\text{Log odds (delista}_i) = \ln \left(\frac{P_i}{1 - P_i} \right) = b_0 + \sum_{k=1}^n b_k X_{k,i} =$$

$$b_0 + b_1 \text{ FIRMAGE}_i + b_2 \text{ FIRMSZ}_i + b_3 \text{ FRMTYPE}_i + b_4 \text{ INSTITUTE}_i + b_5 \text{ LEVERAGE}_i + b_6 \text{ CURRENT}_i + b_7 \text{ GROWTH}_i + b_8 \text{ COVERAGE}_i + b_9 \text{ TURNOVER}_i + b_{10} \text{ ROE}_i + b_{11} \text{ OFFERSZ}_i + b_{12} \text{ ACTIVITY}_i + b_{13} \text{ QLAUDIT}_i + b_{14} \text{ VC}_i + b_{15} \text{ INITIAL}_i + b_{16} \text{ ALPHA}_i + b_{17} \text{ RULES}_i + b_{18} \text{ SCHEDULE}_i \quad (4-5)$$

where;

Odds (delista_{*i*}) = the estimated probability of involuntary delisting of firm *i* (P_i) divided by the estimated probability of survival of firm *i* ($1 - P_i$) within three (five) survival years based on the adjusted survival time for enforcement date;

b_0 = the intercept of the model;

n = number of independent variables;

$X_{k,i}$ = the regressor number "*k*" of firm "*i*";

b_k	=	parameter number "k";
$FIRMAGE_i$	=	the age of firm "i" at the offering date by months;
$FIRMSZ_i$	=	size of firm "i" measured by the natural log of market capitalization adjusted by the CPI at the time of listing;
$FRMTYPE_i$	=	type of firm "i" (privatized or privately-owned firms) at the offering date;
$INSTITUTE_i$	=	the post-IPO percentage of institutional ownership of firm "i";
VC_i	=	venture-capitalist participation of firm "i" before or at the offering date;
$LEVERAGE_i$	=	financial leverage of firm "i" measured by total debts ratio before the offering date;
$CURRENT_i$	=	current ratio of firm "i" before the offering date;
$GROWTH_i$	=	growth rate of total assets of firm "i" before the offering date;
$COVERAGE_i$	=	cash coverage ratio of firm "i" before the offering date;
$TURNOVER_i$	=	total assets turnover ratio of firm "i" before the offering date;
ROE_i	=	return on equity of firm "i" before the offering date;
$OFFERSZ_i$	=	offering size of firm "i" measured by the natural log of gross proceeds adjusted by the CPI at the offering date;
$ACTIVITY_i$	=	IPO activity of firm "i" (issued in hot or cold periods) at the offering date;
$QLAUDIT_i$	=	quality of auditor hired in firm "i" at the offering date;
$INITIAL_i$	=	initial return of firm "i" measured by the percentage of raw return from the offering date to the first trading date;
$ALPHA_i$	=	the post-IPO percentage of insider ownership of firm "i";
$RULES_i$	=	listing date of firm "i" (before August 2002 or on August 2002 onwards) which reflects listing rules variable;
$SCHEDULE_i$	=	listing schedule type of firm "i" at the listing date.

- **Assumptions of Logit and Probit Models**

Logit and probit models are nonlinear regression models. Therefore, the assumptions related to the distribution of independent variables such as linearity, normality and homoscedasticity are not required to execute these models (Schwab,

2010). Nevertheless, these models require some assumptions related to sample size and multicollinearity as follows:

i) Adequate sample size

Logit and probit models require large samples to ensure the accuracy of results. The minimum sample size of 60 cases is deemed sufficient according to some authors (Leech et al., 2005). Others use the rule of thumb of 10 cases for each independent variable (Pallant, 2005; Schwab, 2010). This study uses two samples to analyze delisting rate. The sizes of these two samples are 169 and 178 firms, with 10 (i.e., 169/17) and 10.5 (i.e., 178/17) averages per variable, respectively. Thus, sample sizes employed in the logit and probit models are sufficient.

If the absolute value of firm's standardized residual exceeds 2.58, this firm is considered as an outlier and could be deleted from the analysis (Norusis, 2006; Garson, 2010; Schwab, 2010). The number 2.58 is the *z*-score of 1% significance level. It is used in this study instead of 1.96; which is the *z*-score of 5% significance level, to ensure adequate sample size for the analysis.

ii) No multicollinearity

Tolerance and variance inflation factor (VIF) are the most widely used diagnostics to check multicollinearity problem in OLS regression. Since VIF is the reciprocal value of tolerance, it is sufficient to use VIF to check multicollinearity. These diagnostics depend on R-Square. Since R-Square is not found in logit and probit outputs, some propose using the tolerance and VIF diagnostics resulted from

running LPM (e.g., Leech et al., 2005; Pallant, 2005; Garson, 2010). LPM in this analysis is a multiple linear regression model, where the dependent variable is the delisting status ($delista_i$) and the independent variables are the same as used in the logit and probit models. One common rule of thumb says that VIF value should not exceed 10 to avoid multicollinearity problem (Gujarati, 2003; Garson, 2010). This rule of thumb is used in this study. Multicollinearity could also be detected by the bivariate coefficient of correlation between each pair of independent variables. According to Gujarati (2003), there is no multicollinearity if the absolute coefficient of correlation value is less than 0.80. This rule of thumb is also used in this study.

4.5.2.2 Cox Regression Model

Multiple linear regression model is not suitable for identifying the determinants of survival time because survival data are often positively skewed. To paraphrase, the assumption of normality is not fulfilled (Der & Everitt, 2007; Jain & Kini, 2000). Censoring is another obstacle against the using of the multiple regression model in survival time analysis.

In the IPO context, censored cases are firms included in the study which have not been delisted involuntarily until the end of the study, or those that left the sample before the end of the study for reasons other than failure (Jain & Martin Jr, 2005). These firms may or may not be delisted in the future. Consequently, the exact survival times of these firms are not known. What is known only is that the survival times of these firms are greater than some values. Thus, these firms are commonly having right censoring. Taking censored cases into consideration in survival time models has the advantage of increasing sample size. In turn, forecasting process will

enhance (Jain & Kini, 2000; Jain & Martin Jr, 2005; Kooli & Mekkassi, 2007; Evrensel, 2008). Therefore, survival data require special models.

The survival analysis is also preferred to the logit, probit, and discriminant analyses. This is because survival time analysis takes into account the timing of failure. It deals with time series data with a different time window for each firm based on its IPO and delisting dates. The logit, probit, and discriminant models, however, cannot predict the time of delisting. They can only predict whether a firm will be delisted or not within a given period of time. Thus, it is important to use the survival time analysis because the probability of delisting may differ based on survival time (Jain & Kini 2000; Jain & Martin Jr, 2005; Kooli & Mekkassi, 2007).

The univariate survival time analysis is important as an exploratory stage in the survival time analysis. Nevertheless, it has two main disadvantages. First, it deals only with categorical variables and can not handle continuous variables directly. That is, if the variable is continuous, it should be converted to categorical variable. However, continuous variables produce more information than categorical ones. Second, it does not have control over the other factors that may affect the relationship between the independent variable and the dependent variable (Jain & Martin Jr, 2005; Garson, 2010). Therefore, the need for a multivariate analysis for survival time is important.

Both accelerated failure time (AFT) and Cox regression multivariate models are specialized in dealing with survival time data. Therefore, they could be used to verify the determinants of survival time. However, the AFT model became obsolete after the emergence of Cox regression model. Cox regression has many advantages

when compared with the parametric AFT model (Allison, 2004; Guo, 2010). More specifically, it does not require a particular probability distribution to represent survival times. Thus, it is considered as a distribution-free model. In addition, it can handle time dependent covariates in survival analysis. It can also use both discrete and continuous measurements of survival times (Allison, 2004; Guo, 2010). As a result, several authors (e.g., Allison, 2004) believe that Cox regression model is the best procedure to do the survival time analysis. Consequently, Cox regression is the suitable model for this study. The British statistician David Cox developed this model in 1972 (Cox, 1972). Cox regression model is estimated in the present study as follows (Allison, 2004; Pintilie, 2006; Yang & Sheu, 2006):

$$h_i(t) = h_0(t) \exp\left(\sum_{k=1}^n b_k X_{k,i}\right) = [h_0(t)] \exp(b_0 + b_1 FIRMAGE_i + b_2 FIRMSZ_i + b_3 FRMTYPE_i + b_4 INSTITUTE_i + b_5 LEVERAGE_i + b_6 CURRENT_i + b_7 GROWTH_i + b_8 COVERAGE_i + b_9 TURNOVER_i + b_{10} ROE_i + b_{11} OFFERSZ_i + b_{12} ACTIVITY_i + b_{13} QLAUDIT_i + b_{14} VC_i + b_{15} INITIAL_i + b_{16} ALPHA_i + b_{17} RULES_i + b_{18} SCHEDULE_i) \quad (4-6)$$

where;

- $h_i(t)$ = the hazard function of firm "i" at time "t" defined as the conditional probability that the IPO firm is delisted at time t given that it has not been delisted before that time;
- $h_0(t)$ = the baseline hazard function shared by all firms at time t. It denotes to the hazard function of firms with all explanatory variables equal to zero;
- exp = exponential;
- n = number of independent variables;
- $X_{k,i}$ = the regressor "k" of firm "i";
- b_k = beta coefficient number "k";
- exp (b_k) = the hazard (risk) ratio of regressor "k";
- $FIRMAGE_i$ = the age of firm "i" at the offering date by months;
- $FIRMSZ_i$ = size of firm "i" measured by the natural log of market capitalization adjusted by the CPI at the time of listing;

<i>FRMTYPE_i</i>	=	type of firm "i" (privatized or privately-owned firms) at the offering date;
<i>INSTITUTE_i</i>	=	the post-IPO percentage of institutional ownership of firm "i";
<i>VC_i</i>	=	venture-capitalist participation of firm "i" before or on the offering date;
<i>LEVERAGE_i</i>	=	financial leverage of firm "i" measured by total debts ratio before the offering date;
<i>CURRENT_i</i>	=	current ratio of firm "i" before the offering date;
<i>GROWTH_i</i>	=	growth rate of total assets of firm "i" before the offering date;
<i>COVERAGE_i</i>	=	cash coverage ratio of firm "i" before the offering date;
<i>TURNOVER_i</i>	=	total assets turnover ratio of firm "i" before the offering date;
<i>ROE_i</i>	=	return on equity of firm "i" before the offering date;
<i>OFFERSZ_i</i>	=	offering size of firm "i" measured by the natural log of gross proceeds adjusted by the CPI at the offering date;
<i>ACTIVITY_i</i>	=	IPO activity of firm "i" (hot or cold) at the offering date;
<i>QLAUDIT_i</i>	=	quality of auditor hired in firm "i" at the offering date;
<i>INITIAL_i</i>	=	initial return of firm "i" measured by the percentage of raw return from the offering date to the first trading date;
<i>ALPHA_i</i>	=	the post-IPO percentage of insider ownership of firm "i";
<i>RULES_i</i>	=	listing date of firm "i" (before August 2002 or on August 2002 onwards) which reflects listing rules variable;
<i>SCHEDULE_i</i>	=	listing schedule type of firm "i" at the listing date.

Cox regression model is considered as a semi-parametric model because a parametric form is resulted only from the effect of independent variables, whereas the baseline hazard function takes the nonparametric form. It relies on the partial likelihood estimation method developed by Cox (1972), which depends on the ranks of survival time instead of the real time. The partial likelihood estimation method focuses only on the covariates part (i.e., $\exp\left(\sum_{k=1}^n b_k X_{k,i}\right)$) and discards the baseline hazard function part ($h_0(t)$) during the estimation process (Der & Everitt, 2007; Guo, 2010). The Cox regression model illustrated in Equation 4-6 is also known as the

proportional hazards regression model. The word "proportional" is used because this model assumes that the hazard ratio of two observations is constant over time (Der & Everitt, 2007). However, this assumption should be tested before building Cox regression model. If this assumption is violated, Cox proportional hazards model is not relevant, and Cox non-proportional hazards model should be used instead.

There are four methods identified in Cox regression to deal with tied survival times, namely Breslow, Efron, exact marginal likelihood and exact partial likelihood methods. Survival times are considered as tied when two or more firms have exactly the same value of survival time. Breslow method is the most commonly used method and it is used as the default in most software packages. Efron method is preferred over Breslow method, and it is the recommended method when there are few ties. The exact methods are preferred to the other two methods when there are several ties (Allison, 2004; Kleinbaum & Klein, 2005; Garson, 2010).

- **Assumptions of Cox Regression Model**

Cox regression does not require assumptions about the baseline distribution of survival times. However, this model requires some assumptions related to sample size, multicollinearity, proportional hazards assumption, and the distribution of error terms as follows:

- a) **Adequate sample size**

The total sample size employed in Cox regression is 195 IPO firms with average sample size per variable equals 11.5 (i.e., 195/17). This sample size is larger

than that used in the logit and probit models (169 or 178 IPO firms based on the definition of survival time used). Therefore, sample size is sufficient and more reliable than that used in the logit and probit models.

b) No multicollinearity

Multicollinearity could be checked by VIF and bivariate correlation coefficients. VIF values are obtained from running multiple linear regression model using survival time as the dependent variable. This study relies on the rules of thumb that the VIF value should be less than 10, and the absolute value of the bivariate correlation between each two independent variables should be less than 0.80 to avoid multicollinearity problem (Gujarati, 2003).

c) Proportional hazards (PH)

Proportional hazards assumption means that the hazard ratio of two observations is constant over time (Der & Everitt, 2007). That is, if the firm (a) has a risk of delisting at a given initial time point which is twice as high as that of firm (b), the risk of delisting remains twice as high as all other later time points. This assumption could be tested statistically by **Schoenfeld residuals PH test**. This test checks the null hypothesis that there is no relationship between the log hazard ratio and survival time. The proportional hazards assumption is met when the null hypothesis is not rejected (Kleinbaum & Klein, 2005; Garson, 2010). This test is available in Stata software, and is used in this study to test the PH assumption.

Two methods are commonly used in Cox nonproportional hazards model, namely the stratified Cox regression method and Cox regression with time varying covariates method. The stratified Cox regression method requires the variables that interact with time to be categorical and not of direct interest to the researcher (Allison, 2004; Kleinbaum & Klein, 2005). Further testing of PH assumption is done through Cox regression model with time dependent covariates (Allison, 2004; Kleinbaum & Klein, 2005). In Cox regression model with time varying covariates, the interaction between time dependent variables and time should be included in the model.

The way to include the interaction term between the variable (X) and time (t) in Cox regression model with time varying covariates is expressed in Equation 4-7 (Allison, 2004).

$$\text{Log } h_i(t) = \alpha(t) + (\beta_1 + \beta_2 t) X \quad (4-7)$$

where;

Log $h_i(t)$	=	the natural logarithm of the hazard function (rate);
$\alpha(t)$	=	the natural logarithm of the baseline hazard function;
β_1	=	coefficient of the independent variable (X) at time 0;
β_2	=	coefficient of the interaction term (Xt) between the independent variable (X) and time (t).

d) Assumptions related to outliers and the distribution of error terms

No outliers, no autocorrelation and no heteroskedasticity are assumed in Cox regression model. Robust standard error estimation is the recommended method in nonproportional Cox regression. It is employed to solve the problems related to the distribution of error terms such as autocorrelation and heteroskedasticity (Garson,

2010). In addition, it is a preferred method to deal with outliers (Hamilton, 2006). Therefore, robust standard error estimation method is used in this study.

4.6 DATA COLLECTION PROCESS

This study uses IPO data from the Egyptian stock market that were issues from January 1992 to December 2009. The year of 1992 is chosen as a starting year because the Egyptian Capital Market Law Number 95 is issued in this year. This law is the main factor of the re-emergence of the Egyptian capital market. Meanwhile, December 2009 is chosen as an ending point because data were available to the researcher until that date.

Sample selection process is shown in Table 4.3. The total number of firms that were listed on the EGX from 1992 to 2009 is 1240 firms. There were 352 firms out of the 1240 firms, offered their IPOs in the EGX over the period of 1992-2009. After examining these 352 firms, 59 firms were excluded because they are either financial firms or represent merger and acquisition (M&A) cases. The remaining 293 IPO firms contain 76 involuntary delisted firms and 30 voluntary delisted firms. 98 IPO firms out of the 293 firms are excluded from the analysis due to the unavailability of their prospectuses at the time of the IPO, and / or the unavailability of their financial reports. Therefore, the remaining 195 IPO firms are valid candidates to be included in the sample.¹⁷

¹⁷ These statistics are obtained from the EGX and DataStream Database.

Table 4.3 Sample selection process

Total number of IPO firms from 1992 to 2009	352
(-) Financial firms and M&A	(59)
Total number of IPO firms after excluding financial firms and M&A (the population)	293
(-) Firms whose prospectuses and / or their financial reports are not available	(98)
Total sample size	195

The reason to exclude financial firms from the analysis is that their financial statements have special structure and their accounting practices are subject to special regulations (Jaskiewicz et al., 2005). In addition, the financing decisions of these firms may not reflect the same information as other firms. For instance, a relatively high leverage ratio is normal in financial firms, but it may be considered as an indicator of financial distress in non-financial firms (Byoun, 2007).

Moreover, the financial ratios of financial firms are highly volatile because they are heavily sensitive to economic fluctuations (Md Rus & Abdullah, 2005). Further, this exclusion is consistent with many authors in their studies to investigate firm performance (e.g., Jain & Kini, 1995, 1999b; Bhabra & Pettway, 2003; Jain & Martin Jr, 2005; Jaskiewicz et al., 2005; Demers & Joos, 2007; Goot et al., 2009). Concerning merger and acquisition (M&A), there is a great debate regarding including them in the non-survived group (Yung et al., 2008). Therefore, this study excluded M&A cases from the analysis.

Table 4.4 shows that there are three types of samples used in the present study. Each sample has different size based on the measurement of delisting risk employed. More specifically, Sample 1 uses the whole sample size (i.e., 195 IPO firms) in Cox regression model. Delisting risk is measured in this sample by survival time. Raw and adjusted survival times are the two ways used to define survival time;

as detailed in Section 4.4.1. The number of involuntary delisted firms in Sample 1 is 53 firms either when employing raw or adjusted survival time.

Table 4.4 Sample size and number of involuntary delisted firms based on the measurement of delisting risk and the definition of survival time employed

Sample Name	Measurement of delisting risk	Research Method	Sample Size	Number of involuntary delisted firms based on raw survival time	Number of involuntary delisted firms based on adjusted survival time
Sample 1	Survival time	Survival time analysis based on Cox regression model	195 IPO firms (the whole sample)	53	53
Sample 2	Three-year delisting rate	Binary logit and probit regression models	178 IPO firms [195 – 17 IPO firms which offered their shares after 31 December 2006 and still not delisted until 31 December 2009]	10	38
Sample 3	Five-year delisting rate	Binary logit and probit regression models	169 IPO firms [195 – 26 IPO firms which offered their shares after 31 December 2004 and still not delisted until 31 December 2009]	19	50

In addition, logit and probit models rely on data from Samples 2 and 3. Delisting risk is measured in Sample 2 by the delisting rate within three-year survival time period. Thus, the analysis of survived firms in this sample should be stopped three years before the ending date of this study. Since this study ends on 31 December 2009, any survived firms after December 2006 were not included in Sample 2. There are 20 IPO firms offered their shares after 31 December 2006 from

the total of 195 IPO firms. 3 firms out of these 20 were delisted involuntarily before the ending date of the study. Therefore, these 3 firms were not excluded from the analysis because it is exactly known that they are delisted. The remaining 17 firms were excluded because their delisting status will only be known after the passage of the three-year survival time period. So, the total size of Sample 2 is 178 IPO firms.

By the same token, delisting risk is measured in Sample 3 by the delisting rate within five-year survival time period. If delisting period is five years, instead of three years, the analysis should be stopped on 31 December 2004. The number of IPO firms that offered their shares after 31 December 2004 is 32 firms. These 32 firms contain 6 firms delisted involuntarily, and hence should not be excluded. The remaining 26 firms are not delisted until the end of the study on 31 December 2009. Thus, 26 firms were not included in the analysis because their delisting status is not exactly known at the end of the five years. Therefore, the size of Sample 3 is 169 IPO firms.

Table 4.4 indicates that the number of involuntary delisted firms in samples 2 and 3 varies according to the definition of survival time. To detail, the number of delisted firms in Sample 2 is 10 firms based on raw survival time, and 38 IPO firms based on the adjusted survival time. In addition, the numbers of delisted firms in Sample 3 are 19 and 50 IPO firms based on the raw and adjusted survival time definitions, respectively. Moreover, the comparison of Samples 2 and 3 shows that the number of delisted firms is higher in Sample 3, irrespective of the method employed to define survival time.

Table 4.5 shows the sources of required data to achieve the objectives of this study. It is worth noting that IPO prospectuses are taken as the main source of data for most independent variables. According to Article 4 of the Capital Market Law No. 95 for the year of 1992, these prospectuses should be published in two widely circulated daily morning newspapers. Thus, prospectuses are obtained from the newspapers in addition to the Capital Market Authority (CMA).

Table 4.5 Sources of data

No	Variable Name	Required Data	Sources of Data
1	Delisting risk	Listing date	- EGX monthly bulletin - The Egyptian Exchange website (www.egyptse.com) - Osiris Database
		Delisting date	- EGX monthly bulletin - Egypt information dissemination company (EGID)
		Reason of delisting	- EGX daily and monthly bulletins - Osiris Database - Firm's news on the internet
2	Firm's age	Age of firm on the offering date (by months)	- IPO Prospectus - Kompas Egypt Financial Year Book - Osiris Database
3	Firm size	Number of shares outstanding (on the first trading day)	- DataStream database - Osiris Database - EGX monthly bulletin
		Stock price (on the first trading day)	- DataStream database - Osiris Database - EGX monthly bulletin
		Monthly consumer price index (CPI)	- DataStream database
4	Firm type (private & privatization)	IPO privatized firms	- EGX monthly bulletin
5	Institutional ownership	Institutional ownership in the first annual report after the offering date	- Annual report - Kompas Egypt Financial Year Book
6	Venture capital (VC) backing	Whether there is VC ownership on or before the offering date	- IPO prospectus - Annual report - Kompas Egypt Financial Year Book
7	Financial leverage	Financial statements three years before the offering date	- IPO prospectus
8	Liquidity		- Kompas Egypt Financial Year Book
9	Asset growth rate		- Osiris Database
10	Cash coverage ratio		- Annual report
11	Operating efficiency		
12	Profitability		

Table 4.5 (continued) Sources of data

13	Offer size	Number of shares offered (on the offering date)	- IPO prospectus - EGX daily and monthly bulletins
		Offer Price	
		Monthly consumer price index (CPI)	- DataStream database
14	IPO activity (hot & cold)	Offering date	- IPO prospectus - Kompass Egypt Financial Year Book - Osiris Database
15	Auditor's quality	The name of firm's auditor on the offering date	- IPO prospectus - Kompass Egypt Financial Year Book - Osiris Database
		The big auditors in Egypt	- Wikipedia
16	Initial return	Stock price (on the first trading day)	- DataStream database - Osiris Database - EGX monthly bulletin
		Offer Price	- IPO prospectus - EGX daily and monthly bulletins
		The Egyptian Public Price Index	- DataStream database -
17	Insider ownership	Alpha (In the first annual report after the offering date)	- IPO prospectus - Kompass Egypt Financial Year Book
18	New listing rules	Listing date	- EGX monthly bulletin - The Egyptian Exchange website (www.egyptse.com) - Osiris Database
19	Listing schedules	Listing schedules on the listing date	- EGX monthly bulletin - The Egyptian Exchange website (www.egyptse.com) - Kompass Egypt Financial Year Book

4.7 SUMMARY

This chapter focuses on research methods used in the present study. The theoretical framework is presented in the first part of this chapter. Then, variables and hypotheses of the study are discussed. Afterwards, the measurement of variables used in the study is examined based on literature review and additional arguments. Finally, models used in the study and data collection process are discussed. After discussing hypotheses of the study and research methods in this chapter, data are analyzed in the next chapter.

CHAPTER 5

DATA ANALYSES AND RESEARCH FINDINGS

5.1 INTRODUCTION

This chapter discusses the data analyses and research findings of this study. It is divided into three main sections. Section 5.2 presents results on the determinants of delisting rate. It begins with the univariate analyses based on chi-square test for independence, independent samples t-test, and Mann-Whitney U test. Then, the results of fitting the binary logit and probit regression models are presented to identify the multivariate determinants of delisting rate. Section 5.3 shows the results associated with survival time analysis. It starts with Kaplan-Meier univariate analysis, followed by the Cox regression analysis. This chapter ends with a summary in Section 5.4.

5.2 RESULTS ON THE DELISTING RATE ANALYSIS

In order to achieve comprehensiveness in the findings on the determinants of delisted rate, both delisting rate based on five years survival time, and delisting rate based on three years survival time are analyzed separately. Section 5.2.1 discusses all the analyses involving the former measure of delisting rate in detail, while Section 5.2.2 presents the key findings involving the latter measure of delisting. Then, Section 5.2.3 compares the results of logistic regression analysis based on five years survival time to those based on three years survival time. Finally, Section 5.2.4 repeats this comparison using probit regression analysis instead.

5.2.1 Delisting Rates Based on Five-Year Survival Time

A sample containing 169 IPO firms is used to analyze delisting rates based on five-year survival time, as stated in Table 4.4. The definition of survival time used in this study takes into account the enforcement date, as mentioned earlier in Section 4.4.1.

5.2.1.1 Descriptive and Univariate Analyses of Explanatory Variables for Survived and Delisted Firms

As discussed in Chapter 4, eighteen (18) variables are identified in this study as potential variables contributing towards the firms becoming delisted involuntarily. Six (6) of these variables are categorical variables, namely listing schedules, IPO activity, quality of auditor, venture capital backing, listing rules, and firm type variables, and twelve (12) other are continuous variables, namely firm's age, firm size, financial leverage, current ratio, assets growth rate, cash coverage ratio, assets turnover ratio, ROE, offering size, initial return, insider ownership, and institutional ownership. Initial return variable is measured by two measures, namely raw initial return and market adjusted initial return. Table 5.1 presents the cross tabulation of the categorical variables for survived and delisted firms and the results of chi-square test for independence.

a) Listing schedules

The Egyptian firms could be listed on either the Official or the Unofficial Schedule. The requirements of listing on the Official Schedule are stricter than those

of the unofficial one, as mentioned earlier in Chapter 2. Thus, the majority of firms are listed on the Unofficial Schedule (Bolbol et al., 2005).

Table 5.1 Cross tabulation of delisting status of sample firms based on five years survival time

Variables (n = 169 firms)	Survived N (%)	Delisted N (%)	Total N (%)	Chi-square test (P-value)
a) Listing schedule				
Official	68 (92%)	6 (8%)	74 (100%)	29.149*** (0.000)
Unofficial	51 (54%)	44 (46%)	95 (100%)	
b) IPO activity¹⁸				
Cold period	5 (36%)	9 (64%)	14 (100%)	8.823*** (0.003)
Hot period	114 (73.5%)	41 (26.5%)	155 (100%)	
c) Quality of auditor				
Low	64 (59%)	44 (41%)	108 (100%)	17.872*** (0.000)
High	55 (90%)	6 (10%)	61 (100%)	
d) Venture capital backing				
No	83 (64%)	46 (36%)	129 (100%)	9.649*** (0.002)
Yes	36 (90%)	4 (10%)	40 (100%)	
e) Listing rules¹⁸				
Listed before August 2002	116 (75%)	38 (25%)	154 (100%)	20.083*** (0.000)
Listed on August 2002 onwards	3 (20%)	12 (80%)	15 (100%)	
f) Firm type				
Private	60 (58%)	43 (42%)	103 (100%)	18.725*** (0.000)
Privatized	59 (89%)	7 (11%)	66 (100%)	

Note: *** Indicates significant difference at the 1% level based on two-tailed chi-square test.

Table 5.1 shows that delisting rate is greater in the Unofficial Schedule than in the official one. This result is consistent with the resource-based theory. More specifically, 46% of the IPO firms listed on the Unofficial Schedule are delisted involuntarily within five-year survival time. However, only 8% of the IPO firms

¹⁸ There is one cell has expected frequency less than 5 in each of IPO activity variable and listing rules variable.

listed on the Official Schedule are delisted within the same period. This difference in delisting percentages is expected, as detailed in Chapter 4, and significant at 1% level based on chi-square test (p-value = 0.000).

b) IPO activity

IPO is considered as "active" when it is offered in "hot" issue year, and "inactive" when it is offered in "cold" issue year. Issue year is "hot" when the number of IPOs in that year is greater than the median of all IPOs offered within the period of study, and it is "cold" otherwise, as detailed in Chapter 4.

The delisting rate is shown to be greater in cold periods than in hot ones. Specifically, the percentages of firms delisted involuntarily within five-year survival time are 64% and 26.5% for IPOs issued in cold and hot years, respectively. These results contradict the "window of opportunity hypothesis" of Ritter (1984, 1991) and Loughran and Ritter (1995) discussed in Chapter 3. However, the significance of the difference in delisting percentages based on chi-square test is not reliable since there is one cell with expected frequency less than 5.

c) The quality of auditor

The study indicates that IPO firms audited by reputable auditors have significantly less delisting rate than those audited by non-reputable auditors. To detail, 41% of the IPO firms audited by non-reputable auditors are delisted involuntarily within five-year survival time. However, only 10% of the IPO firms audited by non-reputable auditors are delisted within this period. This difference is significant at 1% level based on chi-square test. This result confirms the arguments

of Jain and Kini (2005), and Demers and Joos (2007), among others, that auditor's quality is a signal of the firm's quality.

d) Venture capital (VC) backing

It is inferred from the chi-square test in Table 5.1 that VC participation decreases the probability of involuntary delisting significantly. This result is in line with the results of Kooli and Meknassi (2007) and Yung et al. (2008), among others. Specifically, the percentages of involuntary delisting are 10% in firms backed by venture capitalists and 36% in non-VC backed firms.

e) Listing rules

Most IPO firms (154 firms) are listed before August 2002. In addition, delisting rate increases, as expected by the resource-based theory, when firm is listed on August 2002 onwards compared with the situation before that date. To detail, the percentages of involuntary delisting are 80% for firms listed on August 2002 onwards, and 25% for firms listed before that date. However, the significance of the difference in delisting percentages based on chi-square test is not reliable since there is one cell with expected frequency less than 5.

f) Firm type

The percentage of involuntary delisting is 42% in private IPOs and 11% in privatization IPOs, and this difference is significant at 1% level based on the chi-square test. This results support the resource-based theory.

Table 5.2 summarizes the mean, median, standard deviation, minimum, maximum, and skewness values for the continuous variables for the overall sample firms. While Table 5.3 compares the mean (mean rank) of these variables for delisted and survived firms based on t-test (Mann Whitney U Test). The differences between the mean values (in independent samples t-test) of these two groups have the same direction compared with the differences between the mean rank values (in Mann-Whitney U test). Therefore, it is sufficient to explain only the results of independent samples t- test. Moreover, the differences between the mean (mean rank) values are statistically significant at the 1% level for all variables mentioned in Table 5.3.

Table 5.2 Descriptive statistics of continuous variables related to five-year delisting rate

<i>Variable (n = 169 firms)</i>	<i>Mean</i>	<i>Median</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Skewness</i>
1- Firm's age (in months)	299.70	240.00	251.84	3.00	1211.00	1.50
2- Firm size (in million L.E)	11.49	1.34	32.23	0.00	282.37	5.43
3- Institutional ownership (in %)	57.55	65.80	27.92	2.00	97.30	-0.63
4- Financial leverage (in %)	67.42	71.98	17.22	16.34	96.80	-0.46
5- Current ratio (times)	1.38	1.06	1.10	0.03	6.62	2.59
6- Assets growth rate (in %)	14.64	6.38	23.47	-37.82	116.35	1.98
7- Cash coverage (times)	31.84	9.02	45.38	-1.79	242.50	2.14
8- Assets turnover (times)	1.09	0.75	1.03	0.00	5.97	1.97
9- ROE (in %)	19.97	15.40	18.18	-54.50	65.12	-0.28
10- Offering size (in million L.E)	4.45	0.53	14.22	0.00	113.93	5.75
11- Raw initial return (in %)	23.21	15.80	43.82	-36.80	450.00	6.17
12- Adjusted initial return (in %)	18.88	12.20	44.30	-65.00	446.30	5.84
13- Alpha (in %)	55.04	55.00	26.12	5.00	97.20	-0.09

Table 5.3 The results of univariate analyses of continuous variables related to five-year delisting rate

<i>Variable</i>	Delisted (n= 50)	Survived (n= 119)	Delisted vs. Survived
	<i>Mean (Mean Rank)</i>	<i>Mean (Mean Rank)</i>	<i>t-stat (z-stat)</i>
1- Firm's age (in months)	194.38 (63.77)	343.95 (93.92)	-4.40 ^{***} (-3.66) ^{***}
2- Firm size (in million L.E)	1.31 (49.58)	15.76 (99.88)	-4.16 ^{***} (-6.10) ^{***}
3- Institutional ownership (in %)	44.47 (62.92)	63.05 (94.28)	-3.83 ^{***} (-3.80) ^{***}
4- Financial leverage (in %)	79.54 (119.12)	62.33 (70.66)	8.44 ^{***} (-5.88) ^{***}
5- Current ratio (times)	0.66 (37.55)	1.68 (104.94)	-8.80 ^{***} (-8.17) ^{***}
6- Assets growth rate (in %)	1.15 (47.54)	20.31 (100.74)	-7.66 ^{***} (-6.45) ^{***}
7- Cash coverage (times)	3.68 (41.73)	43.67 (103.18)	-8.77 ^{***} (-7.45) ^{***}
8- Assets turnover (times)	0.57 (56.63)	1.31 (96.92)	-5.95 ^{***} (-4.89) ^{***}
9- ROE (in %)	5.59 (45.66)	26.01 (101.53)	-7.86 ^{***} (-6.78) ^{***}
10- Offering size (in million L.E)	0.46 (56.98)	6.12 (96.77)	-3.69 ^{***} (-4.83) ^{***}
11- Raw initial return (in %)	6.78 (55.20)	30.12 (97.52)	-4.47 ^{***} (-5.14) ^{***}
12- Adjusted initial return (in %)	0.29 (55.40)	26.70 (97.44)	-3.67 ^{***} (-5.10) ^{***}
13- Alpha (in %)	40.65 (57.14)	61.09 (96.71)	-5.82 ^{***} (-4.80) ^{***}

Note: ^{***} Indicates significant difference between delisted and survived IPO firms at the 1% level, using a two-tailed test. The parametric independent samples t-test is used for differences between means, and the non-parametric Mann-Whitney U test is used for differences between mean ranks.

a) Firm's age

The mean (median) of firm's age from incorporation to the offering date for the whole sample firms is nearly 300 (240) months, with standard deviation equals 251.84 months and skewness equals 1.5. The minimum and maximum values of firm's age are 3 months and 1211 months, respectively. The findings in Table 5.3 conclude that the mean age of the survived firms is significantly higher than that of the delisted firms (343.95 months vs. 194.38 months) with p-value equivalent to 0.000. This result is supportive to the argument of Ritter (1984, 1991) and Hensler et

al. (1997) that firm's age is a negative proxy for risk. It is also consistent with the perspective of the resource-based theory.

b) Firm size

At the first trading day, the mean (median) value of firm size measured by market capitalization adjusted by the CPI for the whole sample firms is 11.49 (1.34) million Egyptian pounds (L.E). The mean size of firms survived for five years (15.76 million Egyptian pounds) is significantly larger than that of firms delisted within the same period (1.31 million Egyptian pounds) at 1% level. This result is consistent with the findings of Peristiani (2003), Boubakri et al. (2005), Li et al. (2006), and Demers and Joos (2007), among others, and supports the perspective of the resource-based theory.

c) Institutional ownership

The mean (median) value of institutional ownership approximately equals 58% (66%). The t-test shows that delisted firms have, on average, significantly lower percentage of institutional ownership than survivors (the mean percentages are 45% and 63%, respectively). These results are supportive to the efficient monitoring hypothesis of Pound (1988).

d) Financial leverage

The mean and median values of financial leverage in the total sample approximately equal 67% and 72%, respectively. The mean comparison as shown in Table 5.3 indicates that delisted firms have significantly higher financial leverage

relative to survived firms at 1% level. This finding is in line with the findings of Baker and Kennedy (2002), Li et al. (2006), and Demers and Joos (2007), among others.

e) Current ratio

The mean (median) of the sample's current ratio is 1.38 (1.06). In addition, the t-test shows that the mean value of current ratio is significantly higher in survived firms than in delisted firms. This result supports both the resource-based theory and the findings of Peristiani (2003) who reports that delisted firms have larger illiquidity risk than survived ones.

f) Growth rate in total assets

Although the mean growth rate in total assets for the whole sample firms is nearly 15%, the median value equals 6.38%. In addition, the average growth rate in total assets is significantly higher, as expected by the resource-based theory, in survived firms than in delisted ones. To detail, 20.31% and 1.15% are the mean values of assets growth rates of survived and delisted firms, respectively.

g) Cash coverage ratio, assets turnover ratio, and return on equity (ROE)

The mean (median) cash coverage value is 31.84 (9.02) for the sample firms. The minimum cash coverage value is -1.79, and the maximum value is 242.5. The lowest and highest values of assets turnover are nearly zero and 5.97, respectively, with mean (median) value equals 1.09 (0.75). The minimum and maximum values of

return on equity (ROE) are -54.5% and 65.12%, respectively, with mean and median values nearly equal 20% and 15%, respectively.

The mean comparison between delisted and survived firms illustrated in Table 5.3 indicates that delisted firms have significantly lower values of cash coverage, operating efficiency, and profitability relative to survived firms. These results support the resource-based theory. More specifically, the average of cash coverage ratio is 3.68 and 43.67 in delisted and survived firms, respectively. In addition, the mean values of assets turnover in delisted and survived firms are 0.57 and 1.31, respectively. Although the average of ROE in delisted firms does not exceed 6%, it exceeds 26% in survived ones. This result is supportive to the findings of prior studies (e.g., Fama & French, 2004; Peristiani & Hong, 2004; Charitou et al., 2007) that delisted firms have significantly less profitability, measured by ROE, than survived ones.

h) Offering size

The mean value of the offering size adjusted by the CPI at the offering date is 4.45 million Egyptian pounds for the total sample. The lowest and highest offering sizes are 73 Egyptian pounds and 113.93 million Egyptian pounds, respectively. The average offering size is less than half million Egyptian pounds in delisted firms. However, it exceeds six million Egyptian pounds in survived firms. The result of t-test indicates that this difference is statistically significant at 1% level; as shown in Table 5.3. This result confirms the negative relationship between offering size and delisting rate as reported by Jain and Kini (1999b), Bhabra and Pettway (2003), and Kooli and Meknassi (2007), among others, and supports the resource-based theory.

i) Initial return

Both raw and market adjusted initial returns are employed in this study. The mean (median) value of raw initial returns in the whole sample is 23.21% (15.8%), and the mean (median) value for market adjusted initial returns is 18.88% (12.2%). The statistical tests indicate that both raw initial return and market adjusted initial return are significantly lower, on average, in the group of delisted firms. More specifically, the average raw initial return in firms delisted within five years is 6.78%. However, that average in firms survived for this period is 30.12%. Similarly, the mean values of adjusted initial returns in firms delisted and those survived are 0.29% and 26.70%, respectively.

The previous results are in line with the signaling hypothesis of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) which considers underpricing as a signal of firm's quality. They are also consistent with the marketing event hypothesis of Chemmanur (1993) and Demers and Lewellen (2003) which regards it as a means for firm's publicity. Moreover, it could be concluded that the univariate analysis gives the same conclusion from using either raw or market adjusted initial return. In addition, the correlation coefficient between these two measures is extremely high (Pearson correlation coefficient is 0.967) and significant at 1% level. Therefore, only raw initial return is used in this study to measure initial return in the logit and probit models employed in this study.

j) Insider ownership

Alpha is the post-IPO percentage of ownership owned by insiders. The average value of alpha is nearly 55% in the total sample. The lowest and highest

insider ownerships are 5% and 97.2%, respectively. In addition, the mean comparison as indicated in Table 5.3 shows that the average percentage of insider ownership is significantly higher in survived firms (about 61%) than in delisted ones (about 41%). These results are in line with the signaling hypothesis of Leland and Pyle (1977) and Grinblatt and Hwang (1989), and the agency cost hypothesis of Jensen and Meckling (1976), discussed in Chapter 3. They also support the findings of Peristiani and Hong (2004), among others, who report a negative relationship between insider ownership and delisting rate.

5.2.1.2 Binary Logit and Probit Regression Analyses

Delisting status is a binary variable that contains two classes. Whereas the first class is the event of interest; which is the involuntary delisting event, the other class is the nonevent; which is the survival. This section presents and discusses the results related to four logistic regression models followed by the results of four probit regression models. It ends with a comparison between the findings of logit and probit models.

A) The Results of Binary Logistic (Logit) Regression models

The absolute value of the standardized residual does not exceed 2.58 for all the sample firms. Hence, no outliers are detected and all firms are used in the analysis. Further, it is not recommended to build logit or probit model that includes all variables examined in this study due to the multicollinearity problem. More specifically, firm size and offering size variables have VIF values greater than 10 (12.336 and 12.957, respectively). In addition, the absolute value of Pearson

correlation coefficient between each pair of independent variables is less than 0.80, except for firm size and offering size variables; which have extremely high coefficient of correlation (0.9248). Thus, there is an evidence of multicollinearity, and these two variables should be modeled separately. Therefore, Model 1 includes all variables studied except offering size (*OFFERSZ*) variable, and Model 2 contains all variables after excluding firm size (*FIRMSZ*) variable. Models 3 and 4 comprise only the significant variables in Models 1 and 2. To detail, Model 3 includes all significant variables except offering size (*OFFERSZ*) variable, and Model 4 contains all significant variables except firm size (*FIRMSZ*) variable.

The significant variables in Models 1 and 2 should not be modeled in only one model due to the multicollinearity problem. To detail, the VIF values of firm size and offering size variables in the model that include all significant variables in Models 1 and 2 are 11.027 and 11.222, respectively. Therefore, the multicollinearity problem is existed, and these two variables should not be included together in one model. Tables 5.4, 5.5, 5.9 and 5.10 indicate that the maximum VIF values in all models employed are less than 10. Therefore, there is no multicollinearity problem in these models.

- **Pseudo R-Square Measures**

Unlike R-Square in linear regression, Pseudo R-Square measures are not considered as goodness of fit measures. They are only considered as positive measures of the strength of association between the dependent variable and the independents (Landau & Everitt, 2004; Garson, 2010).

Table 5.4 Binary logistic regression estimates and overall significance for four alternative models based on five-year survival time period

Variables (n = 169 firms)	Model 1			Model 2			Model 3			Model 4		
	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Odds Ratio (Marginal Effect)
CONSTANT	18.265* (0.051)	85590000.000 (0.001)	2906628.000 (4.1e-04)	14.883 (0.260)	2906628.000 (4.1e-04)	7.905 (0.041)	2.067 (0.467)	7.905 (0.041)	0.136 (0.965)	7.905 (0.041)	1.146 (10e-04)	1.146 (10e-04)
FIRMAGE	0.001 (0.694)	1.001 (6.5e-08)	1.000 (-1.2e-08)	0.000 (0.874)	1.000 (-1.2e-08)							
FIRMSZ	-1.853** (0.017)	0.157 (-1.3e-04)				0.370 (-0.020)	-0.996*** (0.000)	0.370 (-0.020)				
FRMTYPE	-2.065 (0.153)	0.127 (-1.5e-04)	2.298 (2.3e-05)	0.832 (0.654)	2.298 (2.3e-05)							
INSTITUTE	-0.052** (0.049)	0.950 (-3.6e-06)	0.943 (-1.6e-06)	-0.058** (0.043)	0.943 (-1.6e-06)	0.976 (-4.8e-04)	-0.025* (0.062)	0.976 (-4.8e-04)	-0.025* (0.063)	0.976 (-4.8e-04)	0.975 (-1.9e-04)	0.975 (-1.9e-04)
VC	-1.876 (0.339)	0.153 (-1.3e-04)	0.157 (-5.1e-05)	-1.853 (0.313)	0.153 (-5.1e-05)							
LEVERAGE	0.064 (0.170)	1.066 (4.5e-06)	1.091 (2.4e-06)	0.087* (0.085)	1.091 (2.4e-06)	1.053 (0.001)	0.052* (0.082)	1.053 (0.001)	0.089** (0.017)	1.053 (0.001)	1.093 (6.5e-04)	1.093 (6.5e-04)
CURRENT	-1.827 (0.207)	0.161 (-1.3e-04)	0.159 (-5e-05)	-1.841 (0.204)	0.159 (-5e-05)							
GROWTH	-0.186** (0.020)	0.830 (-1.3e-05)	0.825 (-5.3e-06)	-0.192** (0.027)	0.825 (-5.3e-06)	0.908 (-0.002)	-0.096*** (0.002)	0.908 (-0.002)	-0.115*** (0.001)	0.908 (-0.002)	0.891 (-8.4e-04)	0.891 (-8.4e-04)
COVERAGE	-0.031 (0.610)	0.969 (-2.2e-06)	0.945 (-1.5e-06)	-0.056 (0.597)	0.945 (-1.5e-06)							
TURNOVER	-3.820* (0.053)	0.022 (-2.7e-04)	0.025 (-1e-04)	-3.691** (0.048)	0.025 (-1e-04)	0.158 (-0.037)	-1.844*** (0.010)	0.158 (-0.037)	-1.939** (0.012)	0.158 (-0.037)	0.144 (-0.014)	0.144 (-0.014)
ROE	-0.035 (0.398)	0.965 (-2.5e-06)	0.953 (-1.3e-06)	-0.048 (0.328)	0.953 (-1.3e-06)							
OFFERSZ			0.141 (-5.3e-05)	-1.956** (0.015)	0.141 (-5.3e-05)						0.254 (-0.010)	0.254 (-0.010)
ACTIVITY	-6.858	0.001	0.006	-5.115	0.006							

Table 5.4 (continued) Binary logistic regression estimates and overall significance for four alternative models based on five-year survival time period

Variables (n = 169 firms)	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)
QLAUDIT	(0.202) -0.363 (0.768)	(-4.8e-04) 0.696 (-2.5e-05)	(0.643) -0.659 (0.614)	(-1.4e-04) 0.517 (-1.8e-05)				
INITIAL	-0.147** (0.012)	0.863 (-1e-05)	-0.194** (0.013)	0.824 (-5.3e-06)	-0.082*** (0.001)	0.921 (-0.001)	-0.123*** (0.000)	0.885 (-9e-04)
ALPHA	-0.094** (0.026)	0.910 (-6.6e-06)	-0.116** (0.023)	0.891 (-3.2e-06)	-0.044*** (0.006)	0.957 (-8.6e-04)	-0.075*** (0.001)	0.928 (-5.5e-04)
RULES	-5.086 (0.340)	0.006 (-3.6e-04)	-2.437 (0.824)	0.087 (-6.7e-05)				
SCHEDULE	-2.487 (0.120)	0.083 (-1.7e-04)	-2.992 (0.126)	0.050 (-8.2e-05)				
Maximum VIF value	3.066		3.120		1.579		1.566	
LR test χ^2 (P-value)	172.204 (0.000)		173.980 (0.000)		142.951 (0.000)		150.886 (0.000)	
Pseudo R^2	0.839		0.848		0.696		0.735	
Prediction Accuracy	95.3%		95.9%		90.5%		90.5%	
C Statistics	0.993		0.994		0.971		0.979	

Note: ***, ** and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

Table 5.4 shows that Model 2 has the highest McFadden pseudo R-Square value (0.848) followed by Model 1 (0.839), Model 4 (0.735), and Model 3 (0.696), respectively.

- **Goodness-of-Fit Tests**

Likelihood ratio test, Hosmer-Lemeshow test, Wald test, and Score test are the goodness of fit used in logistic regression model. The likelihood ratio test (LR test) of the overall model; also known as Omnibus test, is the most reported goodness-of-fit test in logistic regression model (Garson, 2010). It tests the null hypothesis that there is no significant difference between the model with the predictors and the reduced model with only the intercept (Landau & Everitt, 2004; Leech et al., 2005; Pallant, 2005; Garson, 2010). Therefore, it is employed in this study. Table 5.4 shows that all the four models included are accepted based on LR test, with p-value equals 0.000.

Models 3 and 4 are restricted (reduced) models from their unrestricted (full) Models 1 and 2, respectively. Thus, a comparison between the unrestricted models and their analogous restricted models should be done to decide which models are better. This comparison relies on the likelihood ratio (LR) statistic calculated as “twice the difference in the log-likelihood of the unrestricted model and the log-likelihood of the restricted model” (Wooldridge, 2006). It could also be calculated as the Chi-Square value of the unrestricted model minus the Chi-Square value of the restricted model. Thus, the LR statistic of Models 1 & 3 equals 29.253; calculated as the χ^2 value of Model 1 (172.204) minus the χ^2 value of Model 3 (142.951).

Similarly, the LR statistic of Models 2 & 4 equals 23.094 which is the difference between the χ^2 value of Model 2 (173.980) and the χ^2 value of Model 4 (150.886).

Afterwards, these two LR statistics should be compared with the critical value of χ^2 at 5% significance level with degrees of freedom (df) equivalent to the number of omitted independent variables (q) from the restricted model. Since “q” in each restricted model equals 10 variables, $\chi^2_{5\%, 10}$ (= 18.307) is used as the critical value. It is evident that the values of 29.253 and 23.094 are greater than 18.307. Therefore, the unrestricted models 1 and 2 are preferred to their restricted counterpart models (i.e. Models 3 and 4, respectively).

- **Accuracy of Prediction Based on Classification Tables and C statistics**

The accuracy of prediction could be obtained from classification tables. Several percentages could be obtained from classification tables (Peng & So, 2002; Pallant, 2005; Garson, 2010), namely:

- 1- *Hit rate* = The total percentage of correct predictions (Accuracy of prediction).
- 2- *Sensitivity* = The percentage of correct predictions in the event category of the dependent variable (i.e. in the delisted group).
- 3- *Specificity* = The percentage of correct predictions in the nonevent category of the dependent variable (i.e. in the survived group).
- 4- *False negative rate (Type I error)* = The percentage of firms predicted wrongly as survived firms (i.e., [1 – Sensitivity]).
- 5- *False positive rate (Type II error)* = The percentage of firms predicted wrongly as delisted firms (i.e., [1 – Specificity]).

The receiver operating characteristic (ROC) curve could be used to evaluate the predictive accuracy of the logistic regression model¹⁹. It associates between one minus specificity; known as false positive rate, (in the horizontal axis) and sensitivity (in the vertical axis). Sensitivity and false positive rate are obtained from classification tables using cutoffs from zero to one. The model which has the largest area under the ROC curve is the best model. Thus, the best model should have the highest sensitivity (i.e., all or most delisted firms are accurately predicted) and the lowest false positive rate (i.e., no or few survived firms are classified as delisted firms) (Hosmer & Lemeshow, 2000; Peng & So, 2002; Demers & Joos, 2007). *C* statistic mentioned in Tables 5.4 and 5.5 is the area under the ROC curve (Garson, 2010).

Table 5.4 shows that the prediction accuracy based on classification tables are 95.3%, 95.9%, 90.5%, and 90.5% in Models 1, 2, 3, and 4, respectively. That is, Model 2 is the best model based on prediction accuracy criterion followed by Model 1. In addition, the results of *C* statistics are consistent with those obtained from the prediction accuracy criterion. Specifically, Model 2 has the highest *C* statistic (0.994) followed by Model 1 (0.993), Model 4 (0.979), and Model 3 (0.971), respectively. In summary, Model 2 is the best model based on all criteria of the overall model. Specifically, it has the largest chi-square value in LR test (173.980), the largest Nagelkerke R-Square (0.914), the best prediction accuracy (95.9%), and the highest *C* statistic (0.994).

¹⁹ The ROC curve could also be used in the probit analysis.

- **Wald Test of Individual Model Parameters**

Wald test is the most commonly used test to check the significance of each independent variable's parameter in the binary logistic regression model. Since Models 1 and 2 are better than Models 3 and 4 based on LR statistics, only these two models are highlighted in the following discussion. In addition, Model 2 is the best model based on all criteria used to check the overall significance of logit models employed in this study. Therefore, only its estimates are interpreted in this section (except for *FIRMSZ* variable). The estimates of all other models are interpreted similarly. The logistic regression model is a nonlinear regression model. Thus, beta coefficient of each independent variable cannot be interpreted as the change in the probability of involuntary delisting resulted from changing the independent variable by one unit as usual. The previous interpretation is known as the marginal effect of independent variable.

It is common, however, to use the exponential value of the parameter; known as the odds ratio of independent variable, to interpret the relationships between independent variables and the dependent variable in the logit model. If there is no relationship, odds ratio will be one. If the relationship is negative, the odds ratio will range from zero to less than one. If it is positive, the odds ratio will equal a number greater than one to infinity (Pallant, 2005; Brooks, 2008, 2009; Garson, 2010).

The marginal effect gives a direct and simpler association between the dependent variable and each independent variable. Specifically, it shows the effect of one unit increase in the independent variable on the dependent variable. However, these values are not available in many software packages such as SPSS and EViews.

Fortunately, marginal effects are available in RATS software. Thus, marginal effects obtained from RATS are used to complete the outputs of logistic regression model (Brooks, 2009). Table 5.4 presents beta coefficients (and its significance level), odds ratio, and marginal effect for each independent variable. The odds of involuntary delisting are defined in this study as the ratio of the probability of five-year involuntary delisting to the probability of five-year surviving.

Table 5.4 shows that *INSTITUTE*, *GROWTH*, *TURNOVER*, *INITIAL*, and *ALPHA* variables have significant negative relationships with five-year delisting rate in Models 1 and 2 based on Wald test. In addition, *FIRMSZ* and *OFFERSZ* variables included in Models 1 and 2, respectively, have significant negative relationships with delisting rate. *LEVERAGE* variable has the expected significant positive relationship with delisting rate in Model 2 at 10% level (p-value = 0.085). However, *FIRMAGE*, *FRMTYPE*, *VC*, *CURRENT*, *COVERAGE*, *ROE*, *ACTIVITY*, *QLAUDIT*, *RULES*, and *SCHEDULE* variables are not significant either in Model 1 or in Model 2. The discussion of the significant variables and their relationships with five-year involuntary delisting rate is as follows:

a) Firm size

Table 5.4 reports a significant negative relationship between firm size (*FIRMSZ*) variable and the probability of involuntary delisting in Model 1 at 5% level (p-value = 0.017) with -1.853 beta coefficient. It means that the odds of involuntary delisting decrease by 1.853% with the increase in firm size (i.e., market capitalization adjusted by the CPI) by 1%, holding all other factors constant. In addition, the marginal effect equals -1.3e04, which means that the probability of

involuntary delisting decreases by 0.0000013 (i.e., 0.00013%) with the increase in firm size by 1%, *ceteris paribus*.

The previous result is in line with the results of univariate analysis which support the argument that smaller firms have, on average, more delisting rate. It is also supports the resources-based theory. In addition, it is consistent with the results of many studies such as Peristiani (2003), Boubakri et al. (2005), Li et al. (2006), Charitou et al. (2007), Demers and Joos (2007), and Yung et al. (2008).

b) Institutional ownership

Table 5.4 shows that there is a significant negative relationship between institutional ownership (*INSTITUTE*) and the probability of involuntary delisting because all coefficients related to this variable are negative. This relationship is significant at 5% level in Models 1 and 2 (p-values equal 0.049 and 0.043, respectively). In addition, the odds ratio and the marginal effect of this variable are 0.943 and -1.6e-06 in Model 2, respectively. It means that the odds of involuntary delisting decrease by a factor of 0.943 with the increase in institutional ownership by one unit (1%), *ceteris paribus*. That is, the odds of involuntary delisting decrease by 5.7% (i.e., $100 * [0.943 - 1]$) with the increase in institutional ownership by 1%, *ceteris paribus*. The probability of involuntary delisting decreases by 0.00016% with the increase in institutional ownership by 1%, holding all other factors constant. This result supports both the efficient monitoring hypothesis of Pound (1988) and the results of univariate analysis.

c) Financial leverage

The coefficient of *LEVERAGE* variable is 0.087 in Model 2 with p-value equivalent to 0.085. Thus, a significant positive relationship is reported between leverage and the probability of involuntary delisting at 10% level. In addition, the odds ratio of 1.091 of this variable in Model 2 means that the odds of involuntary delisting increases by a factor of 1.091 with one unit (1%) increase in total debts ratio, holding other predictors equal. In other words, 1% increase in total debts ratio will increase the odds of involuntary delisting by 9.1% (i.e., $100 * [1.091 - 1]$). Furthermore, the marginal effect of *LEVERAGE* variable ($2.4e-06$) suggests that one unit increase in the total debts ratio results in the increase in the probability of involuntary delisting by 0.0000024 (or 0.00024%), holding other factors constant. This result confirms the results of Baker and Kennedy (2002), Li et al. (2006), and Demers and Joos (2007), among others. It is also in line with the results of univariate analysis and the trade-off theory of capital structure; which argues that high leverage leads to high financial distress.

d) Growth rate in assets

The results of the growth rate in assets (*GROWTH*) variable are in line with the resource-based theory, and consistent with the results obtained from the univariate analysis. More specifically, a negative relationship is reported between assets growth rate and delisting rate at 5% significance level in Models 1 and 2 (p-values equal 0.020 and 0.027, respectively). In addition, the odds ratio equals 0.825 in Model 2; which means that one unit (1%) increase in the growth rate of total assets leads to a decrease in the odds of involuntary delisting rate by a factor of 0.825 (i.e.,

by 17.5%), holding other factors equal. In addition, the marginal effect value of *GROWTH* variable is $-5.3e-06$; which means that 1% increase in assets growth rate results in 0.00000053 (or 0.00053%) decrease in delisting rate, holding other predictors constant.

e) Assets turnover ratio

Table 5.4 also indicates that assets turnover (*TURNOVER*) associates negatively, as expected, with the probability of involuntary delisting in Models 1 and 2 at 10% and 5% significance levels, respectively. The odds ratio and marginal effect related to *TURNOVER* variable are 0.025 and -0.0001, respectively, in Model 2. It means that one unit increase in assets turnover ratio would decrease the odds of involuntary delisting by a factor of 0.025, and decrease the probability of involuntary delisting by 0.01%, all other factors being constant. This result is supportive to both the univariate analysis and the resource-based theory. It confirms that survived firms operate their total assets more efficiently compared with other firms.

f) Offering size

The increase in the offering size variable (*OFFERSZ*) decreases the probability of involuntary delisting significantly at 5% (p-value = 0.015) in Model 2. This negative relationship supports the findings of Jain and Kini (1999b), Bhabra and Pettway (2003), and Kooli and Meknassi (2007), among others. It is also consistent with both the results of univariate analysis, and the resource-based theory. In Model 2, the value of beta coefficient equals -1.956, which means that the odds of involuntary delisting decrease by 1.956% for 1% increase in the offering size (i.e.,

the gross proceeds adjusted by the CPI), *ceteris paribus*. Furthermore, the marginal effect of “-5.3e-05” means that 1% increase in the offering size would decrease the probability of involuntary delisting by 0.000053%, holding other factors constant.

g) Initial return

Similar to the results obtained from the univariate analysis, there is a significant negative relationship between initial return variable (*INITIAL*) and the probability of involuntary delisting. This relationship is significant at 5% level in Models 1 and 2. These results are consistent with the signaling hypothesis of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) which considers underpricing as a signal of firm's quality. They are also consistent with the marketing event hypothesis of Chemmanur (1993) and Demers and Lewellen (2003) which regards it as a means for firm's publicity. In addition, this negative relationship is confirmed by the studies of Schultz (1993), Peristiani (2003), Boubakri et al. (2005), Demers and Joos (2007), and Yung et al. (2008).

The odds ratio and the marginal effect related to initial return variable in Model 2 are 0.824 and -5.3e-06, respectively. It means that the odds of involuntary delisting decline by a factor of 0.824 with the increase in the initial return by 1%. In addition, the increase in the initial return by 1% decreases the probability of involuntary delisting by 0.00053%, holding everything else constant.

h) Insider ownership

The expected negative relationship between insider ownership, measured by *ALPHA*, and the probability of delisting involuntarily is confirmed in this study at 5% significance level in Models 1 and 2 (p-values equal 0.026, and 0.023, respectively). This result is in line with the signaling hypothesis of Leland and Pyle (1977), and Grinblatt and Hwang (1989) who claim that insider ownership provides a positive signal of firm's quality. It also supports the interest convergence theory of Jensen and Meckling (1976) who argue that agency costs will reduce with the high percentage of insider ownership. Further, the results obtained from the univariate analysis and the findings of Peristiani and Hong (2004), among others, are supported. The odds ratio related to *ALPHA* equals 0.891 in Model 2, and the marginal effect equals -3.2e-06. It means that 1% increase in insider ownership results in a decrease in the odds of involuntary delisting rate by a factor of 0.819, and a decrease in the probability of involuntary delisting by 0.00032%, holding other factors constant.

B) The Results of Binary Probit Regression models

Table 5.5 presents the results of four probit regression models. These results provide the same significant variables with the same sign, and the same significance level in most cases, compared with those obtained from logit models presented in Table 5.4. In other words, the same conclusion is obtained when employing either the logit or the probit model. The similarity between the results of logit and probit models is attributed to the similarity in their distribution functions, as mentioned in Chapter 4. To detail, that four models are accepted based on the likelihood ratio test at 1% significance level (p-value = 0.000 in each model).

Table 5.5 Binary probit regression estimates and overall significance for four alternative models based on five-year survival time period

Variables (n = 169 firms)	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect
CONSTANT	10.761** (0.046)	2.7e-07	8.428 (0.355)	1.6e-08	1.276 (0.380)	0.045	0.277 (0.869)	0.002
FIRMAGE	0.000 (0.768)	9.6e-12	0.000 (0.744)	-9.1e-13				
FIRMSZ	-1.104** (0.016)	-2.8e-08			-0.563** (0.000)	-0.020		
FRMTYPE	-1.111 (0.163)	-2.8e-08	0.608 (0.562)	1.2e-09				
INSTITUTE	-0.029** (0.050)	-7.5e-10	-0.033** (0.040)	-6.3e-11	-0.014** (0.049)	-5.1e-04	-0.015* (0.058)	-1.1e-04
VC	-1.230 (0.275)	-3.1e-08	-1.175 (0.275)	-2.3e-09				
LEVERAGE	0.038 (0.150)	9.8e-10	0.052* (0.069)	1.0e-10	0.029* (0.059)	0.001	0.050** (0.012)	3.6e-04
CURRENT	-1.105 (0.160)	-2.8e-08	-1.106 (0.155)	-2.1e-09				
GROWTH	-0.113** (0.017)	-2.9e-09	-0.116** (0.022)	-2.2e-10	-0.055*** (0.000)	-0.002	-0.067*** (0.000)	-4.8e-04
COVERAGE	-0.020 (0.565)	-5.1e-10	-0.033 (0.572)	-6.5e-11				
TURNOVER	-0.325** (0.048)	-5.9e-08	-2.191** (0.043)	-4.2e-09	-1.062*** (0.008)	-0.037	-1.135** (0.011)	-0.008
ROE	-0.023 (0.349)	-5.8e-10	-0.030 (0.278)	-5.9e-11				
OFFERSZ			-1.138**	-2.2e-09			-0.800***	-0.006

Table 5.5 (continued) Binary probit regression estimates and overall significance for four alternative models based on five-year survival time period

Variables (n = 169 firms)	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect
ACTIVITY	-4.114 (0.177)	-1.1e-07	(0.013) -3.011 (0.712)	-5.8e-09			(0.000)	
QLAUDIT	-0.165 (0.799)	-4.2e-09	-0.329 (0.630)	-6.4e-10				
INITIAL	-0.085** (0.011)	-2.2e-09	-0.111** (0.011)	-2.2e-10	-0.045*** (0.000)	-0.002	-0.070*** (0.000)	-5e-04
ALPHA	-0.054** (0.022)	-1.4e-09	-0.064** (0.019)	-1.2e-10	-0.026*** (0.005)	-9.0e-04	-0.044*** (0.000)	-3.2e-04
RULES	-3.046 (0.314)	-7.8e-08	-1.395 (0.864)	-2.7e-09				
SCHEDULE	-1.432 (0.113)	-3.7e-08	-1.597 (0.137)	-3.1e-09				
Maximum VIF value	3.066		3.120		1.579		1.566	
LR test χ^2 (P-value)	172.440 (0.000)		174.114 (0.000)		143.691 (0.000)		151.934 (0.000)	
Pseudo R²	0.840		0.848		0.700		0.740	
Prediction Accuracy	95.3%		95.9%		89.9%		90.5%	
C Statistics	0.993		0.993		0.972		0.979	

Note: ***, ** and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

The pseudo R-Square values and the results of goodness-of-fit tests are very close to their counterparts in the logit analysis; where Model 2 is the best model followed by Models 1, 4, and 3, respectively. Firm size, institutional ownership, assets growth rate, assets turnover, offering size, initial return, and insider ownership variables have the expected negative relationships with involuntary delisting rate in all logit and probit models employed. In addition, the relationship between leverage variable and the probability of involuntary delisting is significantly positive in Model 2, 3, and 4 based on either logit or probit model. The LR statistics are 28.749 for Models 1 & 3, and 22.180 for Models 2 & 4. These values are greater than the critical value of 18.307. Thus, similar to the conclusion obtained from the five-year logit models, the unrestricted models (i.e., Models 1 and 2) are preferred to the restricted models (i.e., Models 2 and 4).

5.2.2 Delisting Rates Based on Three Years Survival Time

This section reports the result of the study on the determinants of delisting rate when the measurement of delisted rate is based on three years (instead of five years) survival time. The sample includes 178 observations, 38 are delisted firms and 140 are survived firms. Section 5.2.2.1 presents descriptive and univariate analyses of discrete and continuous explanatory variables for survived and delisted firms. It also shows the results of univariate analysis based on chi-square test for independence (for discrete variables), t- test and Mann Whitney U test (for continuous variables) to test whether these variables are significantly associated with the firms becoming delisted involuntarily. Section 5.2.2.2 then presents the results of the logit and probit regression analyses.

5.2.2.1 Descriptive and Univariate Analyses of Explanatory Variables for Survived and Delisted Firms

Table 5.6 shows the cross tabulation of delisting status of sample firms by listing schedule, IPO activity, auditor's quality, VC backing, listing date and firm type. It is the analogues of Table 5.1, but it relies on three years survival time instead of five years. The results of chi-square test for independence based on three years survival time are qualitatively similar to those based on five years.

Table 5.6 Cross tabulation of delisting status of sample firms based on three years survival time

Variables (n = 178 firms)	Survived N (%)	Delisted N (%)	Total N (%)	Chi-square test (P-Value)
a) Listing schedule				
Official	69 (92%)	6 (8%)	75 (100%)	13.754*** (0.000)
Unofficial	71 (69%)	32 (31%)	103 (100%)	
b) IPO activity²⁰				
Cold period	17 (74%)	6 (26%)	23 (100%)	0.353 (0.361)
Hot period	123 (79%)	32 (21%)	155 (100%)	
c) Quality of auditor				
Low	76 (68.5%)	35 (31.5%)	111 (100%)	18.212*** (0.000)
High	64 (95.5%)	3 (4.5%)	67 (100%)	
d) Venture capital backing				
No	100 (73.5%)	36 (26.5%)	136 (100%)	9.007*** (0.003)
Yes	40 (95%)	2 (5%)	42 (100%)	
e) Listing rules				
Listed before August 2002	125 (81%)	29 (19%)	154 (100%)	4.310** (0.038)
Listed on August 2002 onwards	15 (62.5%)	9 (37.5%)	24 (100%)	
f) Firm type				
Private	75 (71%)	31 (29%)	106 (100%)	9.733*** (0.002)
Privatized	65 (90%)	7 (10%)	72 (100%)	

Note: *** and ** Indicate significant difference at the 1% and 5% levels, respectively, based on two-tailed chi-square test.

²⁰ There is one cell has expected frequency less than 5 in IPO activity variable.

Specifically, listing schedules, quality of auditor, VC backing, and firm type variables are significant at 1% level, with the same direction, based on chi-square test in Tables 5.1 and 5.6. In regard to the IPO activity variable, the significance of the difference in delisting percentage in hot and cold periods based on chi-square test is not reliable since there is one cell with expected frequency less than 5. In addition, listing rules variable is significant at 5% level (0.038) based on chi-square test when using three years survival time, compared with 1% when depending on five years survival time.

Table 5.7 Descriptive statistics of continuous variables related to three-year delisting rate

<i>Variable</i> (n= 178 firms)	<i>Mean</i>	<i>Median</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Skewness</i>
1- Firm's age (in months)	300.30	239.50	250.74	3.00	1211.00	1.47
2- Firm size (in million L.E)	14.64	1.41	46.26	0.00	450.40	6.48
3- Institutional ownership (in %)	58.63	66.20	27.76	2.00	97.30	-0.68
4- Financial leverage (in %)	66.39	71.52	17.87	16.34	96.80	-0.41
5- Current ratio (times)	1.42	1.10	1.11	0.03	6.62	2.46
6- Assets growth rate (in %)	15.14	6.55	23.51	-37.82	116.35	1.88
7- Cash coverage (times)	32.91	9.10	46.01	-1.79	242.50	2.04
8- Assets turnover (times)	1.11	0.79	1.03	0.00	5.97	1.88
9- ROE (in %)	20.44	17.22	18.21	-54.50	65.12	-0.27
10- Offering size (in million L.E)	4.72	0.53	14.46	0.00	113.93	5.41
11- Raw initial return (in %)	24.54	16.30	43.66	-36.80	450.00	5.89
12- Adjusted initial return (in %)	20.16	12.90	44.12	-65.00	446.30	5.58
13- Alpha (in %)	55.92	55.86	26.40	5.00	97.20	-0.16

Table 5.7 presents descriptive statistics of continuous variables related to delisting rate based on three years survival time. 178 IPO firms are the sample firms

employed to analyze delisting rate based on this period. All the 169 IPO firms used to analyze delisting rate based on five years survival time; shown in Table 5.2, are also included in the sample firms based on three years survival time. Thus, Tables 5.7 and 5.2 are quite similar, and the variables in these two tables are interpreted similarly.

Table 5.8 The results of univariate analyses of continuous variables related to three-year delisting rate

<i>Variable</i>	Delisted (n= 38)	Survived (n= 140)	Survived vs. Delisted
	<i>Mean (Mean Rank)</i>	<i>Mean (Mean Rank)</i>	<i>t-stat (z-stat)</i>
1- Firm's age (in months)	204.95 (68.22)	325.84 (95.28)	-3.09 ^{***} (-2.87) ^{***}
2- Firm size (in million L.E)	1.80 (53.24)	18.12 (99.34)	-3.70 ^{***} (-4.89) ^{***}
3- Institutional ownership (in %)	42.44 (60.16)	63.02 (97.46)	-3.90 ^{***} (-3.96) ^{***}
4- Financial leverage (in %)	79.25 (127.32)	62.90 (79.24)	7.16 ^{***} (-5.10) ^{***}
5- Current ratio (times)	0.70 (35.74)	1.61 (104.09)	-6.28 ^{***} (-7.25) ^{***}
6- Assets growth rate (in %)	0.40 (43.26)	19.14 (102.05)	-7.84 ^{***} (-6.24) ^{***}
7- Cash coverage (times)	7.10 (39.01)	39.91 (103.20)	-5.65 ^{***} (-6.81) ^{***}
8- Assets turnover (times)	0.51 (51.86)	1.28 (99.72)	-6.64 ^{***} (-5.08) ^{***}
9- ROE (in %)	5.78 (44.45)	24.42 (101.73)	-6.95 ^{***} (-6.08) ^{***}
10- Offering size (in million L.E)	0.75 (64.03)	5.80 (96.41)	-3.63 ^{***} (-3.44) ^{***}
11- Raw initial return (in %)	6.70 (56.42)	29.38 (98.48)	-2.90 ^{***} (-4.47) ^{***}
12- Adjusted initial return (in %)	0.40 (58.84)	25.52 (97.82)	-3.19 ^{***} (-4.14) ^{***}
13- Alpha (in %)	32.74 (43.14)	62.21 (102.08)	-9.48 ^{***} (-6.25) ^{***}

Note: ^{***} Indicates significant difference between delisted and survived IPO firms at 1% level, using a two-tailed test. The parametric independent samples t-test is used for differences between means, and the non-parametric Mann-Whitney U test is used for differences between mean ranks.

The results of univariate analyses of continuous variables related to delisting rate based on three years survival time are presented in Table 5.8. The number of firms delisted and those survived used in these analyses are 38 and 140, respectively. These results give identical conclusions compared with those based on five years

survival time; illustrated in Table 5.3. More specifically, the differences between the mean (mean rank) values are statistically significant at 1% significance level based on t-test (Mann-Whitney U test) for all variables mentioned in Table 5.8. In addition, firm's age, firm size, institutional ownership, current ratio, asset growth, cash coverage, asset turnover, ROE, offering size, raw and market adjusted initial returns, and insider ownership variables have significant negative relationships with delisting rate. Furthermore, financial leverage variable has a significant positive relationship with the probability of involuntary delisting.

5.2.2.2 Binary Logit and Probit Regression Analyses

Tables 5.9 and 5.10 show the results of four binary logit and probit models, respectively. All these models are free from multicollinearity problem. No outliers are detected because the absolute value of standardized residuals is less than 2.58 for all the 178 firms used.

a) The four alternative models

It is not accepted to build a model including all the 18 independent variables examined in the present study due to the multicollinearity problem. More specifically, the VIF values of firm size (*FIRMSZ*) and offer size (*OFFERSZ*) variables, in the model which contains all the 18 predictors, are 11.669 and 12.395, respectively. In addition, the Pearson correlation coefficient between these two variables is extremely high (0.9204). Thus, the assumption of no multicollinearity is violated in this full model because the VIF values of *FIRMSZ* and *OFFERSZ* variables are greater than 10. Therefore, these two variables should not be included together in one model.

Table 5.9 (continued) Binary logistic regression estimates and overall significance for four alternative models based on three-year survival time period

Variables (n = 178 firms)	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)	Coefficient (p-value)	Odds Ratio (Marginal Effect)
QLAUDIT	(0.230) -1.863*	(-0.006) 0.155	(0.218) -1.985*	(-0.004) 0.137	-1.0319 (0.122)	0.267 (-0.017)	-1.308 (0.126)	0.270 (-0.014)
INITIAL	(0.073) -0.087***	(-0.006) 0.917	(0.063) -1.109***	(-0.004) 0.897	(0.002) -0.064***	0.938 (-8.2e-04)	(0.001) -0.075***	0.928 (-8.3e-04)
ALPHA	(0.004) 0.135***	(-2.7e-04) 0.874	(0.002) -0.157***	(-2e-04) 0.854	(0.002) -0.102***	0.903 (-0.001)	(0.001) -0.113***	0.893 (-0.001)
RULES	(0.000) -1.963	(-4.2e-04) 0.141	(0.000) -2.059	(-3e-04) 0.128	(0.000) (0.225)	(-0.004) 0.037	(0.000) -1.847**	(-0.001) 0.158
SCHEDULE	(0.257) -2.783*	(-0.006) 0.062	(0.225) -3.285*	(-0.004) 0.037	(0.057) -2.013**	(-0.006) 0.134	(0.026) -1.847**	(-0.020) 0.158
Maximum VIF value	2.955		2.931		1.271		1.348	
LR test χ^2 (P-value)	131.331 (0.000)		134.354 (0.000)		122.695 (0.000)		125.516 (0.000)	
Pseudo R^2	0.711		0.728		0.665		0.680	
Prediction Accuracy	93.8%		94.9%		92.7%		92.7%	
C Statistics	0.978		0.981		0.968		0.969	

Note: ***, ** and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

Table 5.10 Binary probit regression estimates and overall significance for four alternative models based on three-year survival time period

Variables (n = 178 firms)	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect
CONSTANT	3.839* (0.052)	0.030	3.520* (0.079)	0.020	3.281*** (0.000)	0.099	3.427*** (0.000)	0.077
FIRMAGE	0.001 (0.250)	10e-06	0.001 (0.289)	6.8e-06				
FIRMSZ	-0.244** (0.031)	-0.002			-0.236*** (0.000)	-0.007		
FRMTYPE	-0.360 (0.602)	-0.003	0.029 (0.970)	1.7e-04				
INSTITUTE	-0.017** (0.028)	-1.4e-04	-0.017** (0.035)	-9.9e-05	-0.020*** (0.002)	-0.06e-04	-0.020*** (0.004)	-4.4e-04
VC	0.400 (0.607)	0.003	0.481 (0.546)	0.003				
LEVERAGE	0.017 (0.342)	1.3e-04	0.020 (0.280)	1.1e-04				
CURRENT	0.176 (0.647)	0.001	0.176 (0.622)	0.001				
GROWTH	-0.044** (0.021)	-3.4e-04	-0.044** (0.021)	-2.5e-04	-0.042*** (0.002)	-0.001	-0.041*** (0.004)	-9.2e-04
COVERAGE	0.010 (0.340)	7.9e-05	0.012 (0.271)	6.6e-05				
TURNOVER	-0.592 (0.177)	-0.005	-0.582 (0.190)	-0.003				
ROE	-0.012 (0.443)	-9.4e-05	-0.013 (0.417)	-7.3e-05				
OFFERSZ			-0.309** (0.014)	0.002			-0.298*** (0.000)	-0.007
ACTIVITY	-0.847 (0.325)	-0.007	-0.744 (0.397)	-0.004				
QLAUDIT	-0.550 (0.259)	-0.004	-0.528 (0.288)	-0.003				
INITIAL	-0.440*** (0.005)	-3.5e-04	-0.052*** (0.002)	-3e-04	-0.037*** (0.000)	-0.001	-0.045*** (0.000)	-0.001

Table 5.10 (continued) Binary probit regression estimates and overall significance for four alternative models based on three-year survival time period

Variables (n = 178 firms)	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect	Coefficient (p-value)	Marginal Effect
ALPHA	-0.060*** (0.000)	-4.7e-04	-0.067*** (0.000)	-3.9e-04	-0.049*** (0.000)	-0.001	-0.057*** (0.000)	-0.001
RULES	-0.889 (0.346)	-0.007	-0.839 (0.364)	-0.005				
SCHEDULE	-1.173 (0.118)	-0.009	-1.310 (0.106)	-0.008				
Maximum VIF value	2.955		2.931		1.165		1.179	
LR test χ^2 (P-value)	127.926 (0.000)		130.131 (0.000)		112.185 (0.000)		116.911 (0.000)	
Pseudo R^2	0.693		0.705		0.608		0.633	
Prediction Accuracy	93.8%		94.4%		91.0%		91.6%	
C Statistics	0.978		0.979		0.960		0.965	

Note: ***, ** and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

As such, Model 1 includes all predictors except *OFFERSZ* variable, and Model 2 contains all variables without *FIRMSZ* variable. Model 3 includes all significant variables in Models 1 and 2 after excluding *OFFERSZ* variable, and Model 4 comprise all these significant variables but after excluding *FIRMSZ* variable. All maximum values of VIF in Tables 5.9 and 5.10 are less than 10. In addition, the absolute value of Pearson correlation coefficient for each pair of independent variables is less than 0.80. Thus, there is no multicollinearity problem in all logit and probit models employed.

The results of the three-year logit model illustrated in Table 5.9 show that the LR statistic related to Models 1 & 3 equals 8.636 [i.e., 131.331 – 122.695], and the LR statistic related to Models 2 & 4 equals 8.838 [i.e., 134.354 – 125.516]. However, the critical value of $\chi^2_{5\%, 10}$ equals 18.307. It means that the LR statistics are less than the critical value. Thus, the restricted models (Models 3 and 4) are preferred to the unrestricted models (Models 1 and 2). Similarly, the LR statistics related to Models 1 & 3, and 2 & 4 in the probit analysis illustrated in Table 5.10 equal 15.741 and 13.220, respectively. These statistics are less than the critical value of $\chi^2_{5\%, 12}$ which equals 21.026; where the number of omitted predictors (q) in the restricted models "3 and 4" equals 12 variables in each model. Again, Models 3 and 4 are better than Models 1 and 2. Moreover, Model 4 has better values based on the overall criteria employed either in the three-year logit or the three-year probit analyses used compared with Model 3.

b) Comparing logit and probit models

Both logit and probit models presented in Tables 5.9 and 5.10, respectively, give similar, but not identical, conclusions based on the restricted Models 3 and 4. Specifically, the overall significance of all logit and probit models are accepted based on the LR test with p-values equivalent to (0.000). In addition, Model 4 has higher Pseudo R^2 values and better goodness-of-fit results compared with Model 3. Moreover, all significant variables in the probit models (i.e., *FIRMSZ*, *INSTITUTE*, *GROWTH*, *OFFERSZ*, *INITIAL*, and *ALPHA*) are also significant in the logit models with the same sign, and the same significance level in most cases. The quality of auditor (*QLAUDIT*) variable is not significant in Models 3 and 4 based on the three-year logit analysis. It is also not included in Models 3 and 4 in the three-year probit analysis. Additionally, the schedule type (*SCHEDULE*) variable is significant in all the three-year logit models, and not included in Models 3 and 4 in the three-year probit analysis. *QLAUDIT* and *SCHEDULE* variables are not included in Models 3 and 4 in the three-year probit analysis because they are neither significant in Model 1 nor in Model 2.

5.2.3 Comparing the Results of Logistic Regression Analysis based on Five Years Survival Time to those based on Three Years Survival Time

There are similarities between the results of logit models indicated in Tables 5.4 and 5.9. More specifically, all these models have an overall significance at 1% level based on LR test. In addition, the prediction accuracy and *C* statistics are more than 90% in all logit models employed. However, the overall significance is better in the case where the delisting rate is determined based on five years survival time.

By comparing the significant variables in the logit models illustrated in Tables 5.4 and 5.9, it is found that six variables are significant with the same expected sign in all logit models shown in these two tables. These variables are *FIRMSZ*, *INSTITUTE*, *GROWTH*, *OFFERSZ*, *INITIAL*, and *ALPHA*. However, *TURNOVER* and *LEVERAGE* variables are found to be significant in determining the delisting rate based on five years survival time and not delisting rate in three years survival time.

Moreover, *SCHEDULE* variable is only significant in the three-year logit models. Firms listed on the Official Schedule have significantly less delisting rate relative to those listed on the Unofficial Schedule. This finding is consistent with the results of univariate analysis related to *SCHEDULE* variable. Based on the results of Model 4, the odds of involuntary delisting for firms listed on the Official Schedule are 0.158 times the odds for firms listed on the Unofficial Schedule. In addition, firms listed on the Official Schedule are 2% less subject to involuntary delisting than those listed on the Unofficial Schedule, all other factors being constant.

5.2.4 Comparing the Results of Probit Regression Analysis based on Five Years Survival Time to those based on Three Years Survival Time

The overall significance of all probit models indicated in Tables 5.5 and 5.10 are accepted based on the LR test at 1% significance level. In addition, Pseudo R-Square values and the results of goodness-of-fit tests are generally better in the models that rely on five years survival time. By comparing the significant variables of the probit models that rely on five years and three years survival times, two notes are concluded. Firstly, all significant variables based on three years survival time are

also significant based on five years survival time. Specifically, *FIRMSZ*, *INSTITUTE*, *GROWTH*, *OFFERSZ*, *INITIAL*, and *ALPHA* variables are significant in all probit models in Tables 5.5 and 5.10. Secondly, *TURNOVER* and *LEVERAGE* variables are found to be significant in determining the delisting rate based only on five-year delisting rate analysis.

5.3 RESULTS ON THE SURVIVAL TIME ANALYSIS

The data for survival time analysis consists of 195 IPO firms, as stated in Table 4.4. The adjusted survival time for enforcement date is employed in this study. The survival time analysis is discussed in four subsections. Firstly, the descriptive analysis on the categorical and continuous variables examined in this study is presented in Section 5.3.1. Section 5.3.2 discusses the results of Kaplan Meier survival analysis. It presents some descriptive and univariate analyses related to survival time. Finally, the analysis of Cox regression model is discussed in Section 5.3.3.

5.3.1 Descriptive Analysis

Figure 5.1 shows the composition of firms by industry type. The sector that contains the most number of sample firms is the construction sector (37 firms), followed by the food and beverages (36 firms) sector. However, media and technology sectors include the least number of sample firms (1 firm each) followed by telecommunications and oil & gas sectors (2 firms each).

Figure 5.1 The composition of IPO firms by industry type

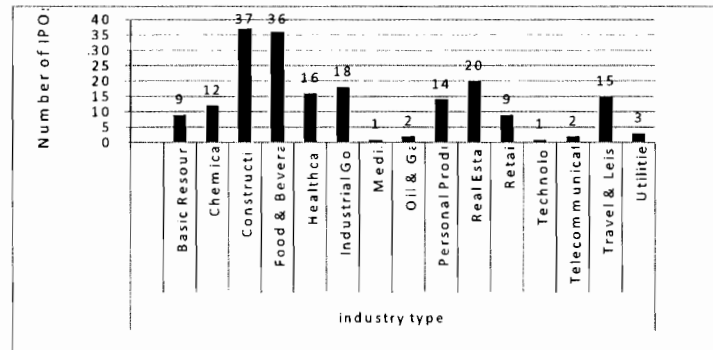


Table 5.11 Descriptive statistics on categorical variables of the sample examined in survival time analysis

Variables	n	(%)
a) Listing schedule		
Official	75	38%
Unofficial	120	62%
b) IPO activity		
Cold period	35	20%
Hot period	160	80%
c) Quality of auditor		
low	122	63%
high	73	37%
d) Venture capital backing		
No	144	74%
Yes	51	26%
e) Listing rules		
Listed before August 2002	154	79%
Listed on August 2002 onwards	41	21%
f) Firm type		
Private	121	62%
Privatized	74	38%

Table 5.11 summarizes the descriptive statistics on the categorical variables of the sample examined in this study. The majority of the sample firms are listed on the Unofficial Schedule (120 firms), issued in hot period (160 firms), audited by low quality auditors (122 firms), are not backed by venture capitalists' (144 firms), listed before August 2002 (154 firms), and are private IPOs (121 firms). In addition, Table 5.12 shows descriptive statistics of continuous variables used in survival time

analysis. The detailed description of these variables is similar to that used in explaining Table 5.2 related to delisting rate discussed in Section 5.2.1.1.

Table 5.12 Descriptive statistics of continuous variables related to survival time analysis

<i>Variable (n = 195 firms)</i>	<i>Mean</i>	<i>Median</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Skewness</i>
1- Firm's age (in months)	288.84	228.00	248.27	3.00	1211.00	1.51
2- Firm size (in million L.E)	14.89	1.29	47.72	0.00	450.40	6.07
3- Institutional ownership (in %)	59.84	67.00	27.05	2.00	97.30	-0.77
4- Financial leverage (in %)	65.52	70.76	17.98	16.34	96.80	-0.34
5- Current ratio (times)	1.49	1.14	1.22	0.03	7.07	2.39
6- Asset growth (in %)	15.06	6.80	23.12	-37.82	116.35	1.87
7- Cash coverage (times)	33.24	9.17	46.19	-1.79	242.50	2.00
8- Assets turnover (times)	1.13	0.80	1.04	0.00	5.97	1.81
9- ROE (in %)	20.24	17.09	17.70	-54.50	65.12	-0.23
10- Offer size (in million L.E)	4.39	0.42	13.87	0.00	113.93	5.66
11- Initial return (in %)	25.31	17.10	43.76	-36.80	450.00	5.62
12- Adjusted initial return (in %)	21.55	14.50	44.75	-65.00	446.30	5.28
13- Alpha (in %)	57.89	58.40	26.31	5.00	97.20	-0.26

5.3.2 Univariate Analysis

Kaplan Meier survival time analysis is used for performing univariate survival analysis. In order to employ Kaplan-Meier method, all independent variables have to be either in the form of categorical or dummy variables. Thus, the thirteen continuous variables, mentioned in Table 5.12, are converted to dummy variables. One commonly used method to dichotomize a continuous variable is to divide it into two groups by the median value (Clarkson & Merkley, 1994; Jain & Martin Jr, 2005). Therefore, this method is used in this study.

Table 5.13 Univariate survival time analysis based on Kaplan-Meier method

Variable	Means for survival time (month)	# IPO firms	# IPO delisted firms (%)	# IPO censored firms ²¹ (%)	Overall comparisons		
					χ^2 of Log Rank test (P-Value)	χ^2 of Breslow test (P-Value)	χ^2 of Tarone-Ware test (P-Value)
1- Firm's age • Young • Old	62.391	98	37 (37.8%)	61 (62.2%)	13.813*** (0.000)	12.994*** (0.000)	13.496*** (0.000)
	64.829	97	16 (16.5%)	81 (83.5%)			
2- Firm size • Small • Large	53.139	98	43 (43.9%)	55 (56.1%)	30.061*** (0.000)	27.177*** (0.000)	28.774*** (0.000)
	78.213	97	10 (10.3%)	87 (89.7%)			
3- Firm type • Private • Privatized	62.853	121	45 (37.2%)	76 (62.8%)	18.316*** (0.000)	17.863*** (0.000)	18.201*** (0.000)
	67.351	74	8 (10.8%)	66 (89.2%)			
4- Institutional ownership • Low • High	61.957	98	40 (40.8%)	58 (59.2%)	17.159*** (0.000)	16.932*** (0.000)	17.180*** (0.000)
	65.784	97	13 (13.4%)	84 (86.6%)			
5- VC backing • No • Yes	57.506	144	46 (31.9%)	98 (68.1%)	5.588** (0.018)	6.752*** (0.009)	6.230*** (0.013)
	78.255	51	7 (13.7%)	44 (86.3%)			
6- Financial leverage • Low • High	82.076	98	4 (4.1%)	94 (95.9%)	50.937*** (0.000)	48.797*** (0.000)	50.230*** (0.000)
	50.674	97	49 (50.5%)	48 (49.5%)			
7- Current ratio • Low • High	50.035	100	50 (50%)	50 (50%)	56.549*** (0.000)	55.586*** (0.000)	56.461*** (0.000)
	83.145	95	3 (3.2%)	92 (96.8%)			
8- Asset growth rate • Low • High	50.265	98	47 (48%)	51 (52%)	47.692*** (0.000)	48.479*** (0.000)	48.436*** (0.000)
	81.936	97	6 (6.2%)	91 (93.8%)			
9- Cash coverage					56.033***	54.921***	55.831***

²¹ Censored cases are firms that did not witness the involuntary delisting event until the end of the study; on 31 December 2009

Table 5.13 (continued) Univariate survival time analyses based on Kaplan-Meier method

Variable	Means for survival time (month)	# IPO firms	# IPO delisted firms (%)	# IPO censored firms ²¹ (%)	Overall comparisons		
					χ^2 of Log Rank test (P-Value)	χ^2 of Breslow test (P-Value)	χ^2 of Tarone-Ware test (P-Value)
• Low	49.950	98	49 (50%)	49 (50%)	(0.000)	(0.000)	(0.000)
• High	82.552	97	4 (4.1%)	93 (95.9%)			
10- Assets turnover							
• Low	51.664	101	43 (42.6%)	58 (57.4%)	27.102 ^{***}	31.338 ^{***}	29.501 ^{***}
• High	80.385	94	10 (10.6%)	84 (89.4%)	(0.000)	(0.000)	(0.000)
11- ROE							
• Low	50.231	98	48 (49%)	50 (51%)	52.644 ^{***}	51.211 ^{***}	52.241 ^{***}
• High	81.945	97	5 (5.2%)	92 (94.8%)	(0.000)	(0.000)	(0.000)
12- Offering size							
• Low	61.854	98	39 (39.8%)	59 (60.2%)	18.692 ^{***}	16.108 ^{***}	17.469 ^{***}
• High	64.828	97	14 (14.4%)	83 (85.6%)	(0.000)	(0.000)	(0.000)
13- IPO activity							
• Cold	56.238	35	9 (25.7%)	26 (74.3%)	1.085	0.717	0.888
• Hot	69.733	160	44 (27.5%)	116 (72.5%)	(0.298)	(0.397)	(0.346)
14- Quality of auditor							
• Low	54.554	122	45 (36.9%)	77 (63.1%)	16.907 ^{***}	19.425 ^{***}	18.354 ^{***}
• High	80.325	73	8 (11%)	65 (89%)	(0.000)	(0.000)	(0.000)
15- Raw initial return							
• Low	60.769	99	44 (44.4%)	55 (55.56%)	26.869 ^{***}	24.549 ^{***}	25.877 ^{***}
• High	66.863	96	9 (9.38%)	87 (90.63)	(0.000)	(0.000)	(0.000)
16- Adjusted initial return							
• Low	62.043	98	43 (43.9%)	55 (56.1%)	22.185 ^{***}	18.994 ^{***}	20.679 ^{***}
• High	65.817	97	10 (10.3%)	87 (89.7%)	(0.000)	(0.000)	(0.000)
17- Insider ownership (alpha)							
• Low	50.892	98	44 (44.9%)	54 (55.1%)	31.243 ^{***}	36.343 ^{***}	34.140 ^{***}
• High	81.239	97	9 (9.3%)	88 (90.7%)	(0.000)	(0.000)	(0.000)
18- Listing rules							
• Before Aug. 2002	61.190	154	41 (26.6%)	113 (73.4%)	4.669 ^{**}	4.024 ^{**}	4.334 ^{**}
• On Aug. 2002 onwards	57.673	41	12 (29.3%)	29 (70.7%)	(0.031)	(0.045)	(0.037)
19- Schedule type							
• Unofficial	54.787	120	46 (38.3%)	74 (61.7%)	24.227 ^{***}	22.210 ^{***}	23.355 ^{***}
• Official	79.300	75	7 (9.3%)	68 (90.7%)	(0.000)	(0.000)	(0.000)

Note: *** and ** indicate significant difference between the two groups of independent variable at 1% and 5% level, respectively.

Table 5.13 presents Kaplan-Meier survival analysis. It discusses the univariate analyses related to survival time. Each independent variable in that table has two categories. The mean values of survival time as well as the number of total, delisted and censored IPO firms in each category are indicated in this table. Censored cases are firms that did not witness the event of interest until the end of the study (Der & Everitt, 2007). In other words, censored cases in this study include all IPO firms survived until the end of the study (on 31 December 2009), in addition to those delisted voluntarily within the period of study (from January 1992 to 31 December 2009).

The mean survival time of the total sample is 69.168 months. The majority of these firms are considered as censored cases (142 censored firms vs. 53 delisted firms) since they survive up to the end of study period, which is 31 December 2009. Log rank, Breslow and Tarone-Ware tests are used to test the null hypothesis that there is no difference between the survival functions of the two categories of each independent variable. These tests often give very similar results (Marques de Sá, 2007; Garson, 2010).

The results of Table 5.13 show that the null hypothesis is rejected in all variables, except in the IPO activity variable, based on the results of log rank, Breslow and Tarone-Ware tests. In other words, there is a significant difference between the survival functions of the two categories of each predictor in all variables except IPO activity variable. In regard with IPO activity variable, there is no significant difference between the survival functions of IPOs issued in hot-issue periods and those issued in cold-issue ones.

Initial return variable is measured by two measures, namely raw initial return and adjusted initial return. The results of these two measures give the same conclusion with the same significance level. In addition, the bivariate Pearson correlation coefficient between these two measures is extremely high (0.966). Therefore, only raw initial return is used in Cox regression models employed in this study. The results of firm's age²², financial leverage and IPO activity variables are detailed, as examples, in the remainder of this section.

Based on the results of firm's age variable illustrated in Table 5.13, it is evident that young firms have higher percentage of delisted firms in comparison to old ones (37.8% vs. 16.5%). In addition, the hazard function curve of old firms is under the hazard function curve of young firms, as illustrated in Figure 5.2, which means that the delisting risk is less in old firms. Furthermore, the mean survival time of young firms (62.391 months) is less than that of old firms (64.829 months). Figure 5.2 and Table 5.13 also show that the survival function curve of old firms is higher than that of young firms, and the difference between the two survival distributions are significant at 1% level based on log rank, Breslow and Tarone-Ware tests. The previous results confirm the expected positive relationship between firm's age and survival time, and support the results of Hensler et al. (1997), Jain and Martin Jr (2005), Li et al. (2006), and Yang and Sheu (2006), among others.

²² All independent variables used in this study, except leverage and IPO activity variables, have similar survival functions.

Figure 5.2 Survival and hazard functions' curves of firm's age variable

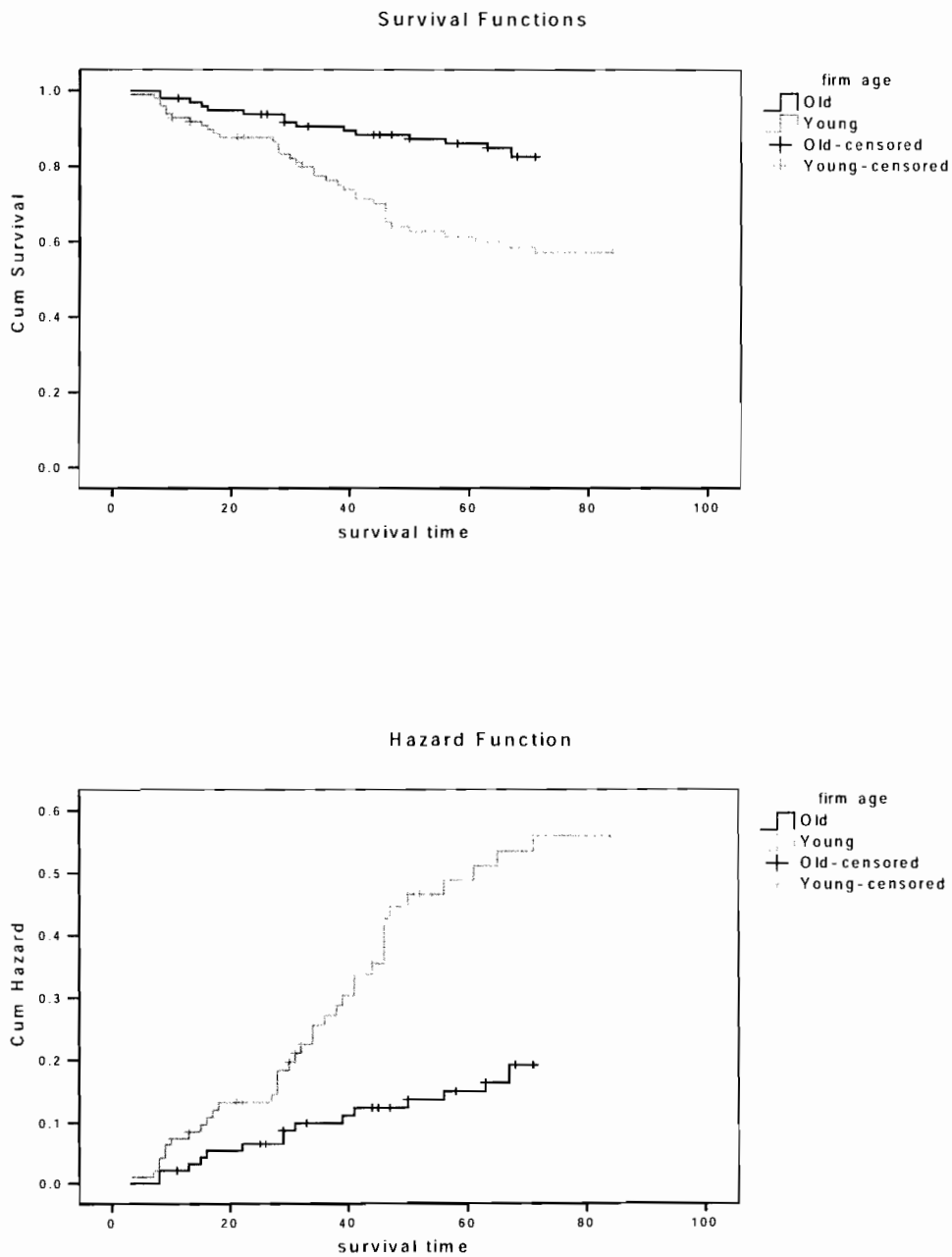
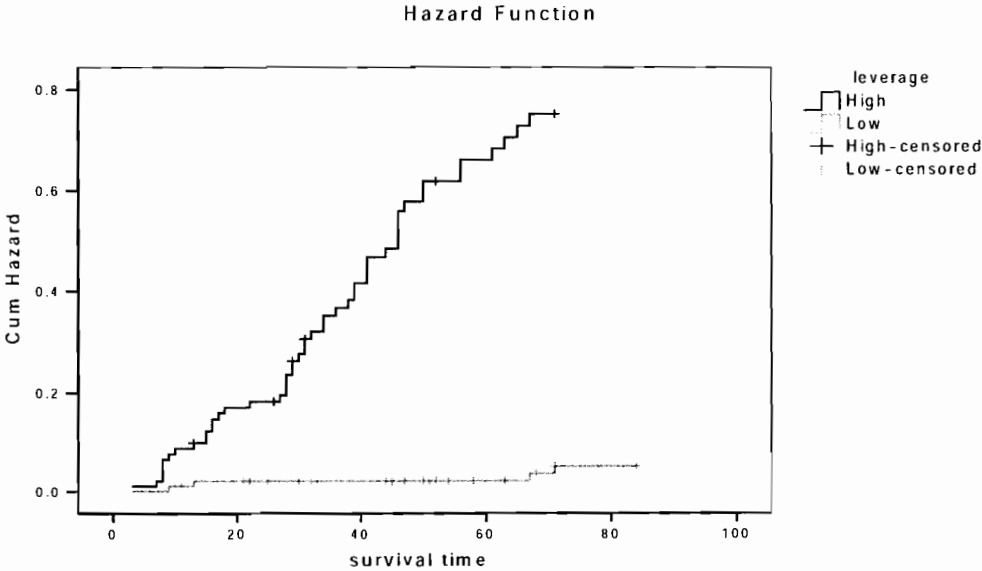
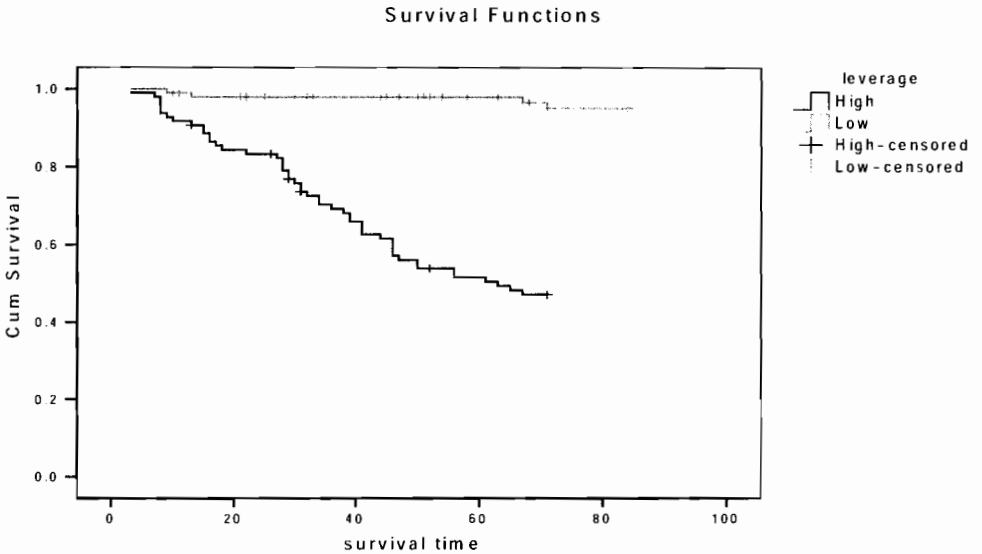


Figure 5.3 Survival and hazard functions' curves of financial leverage variable

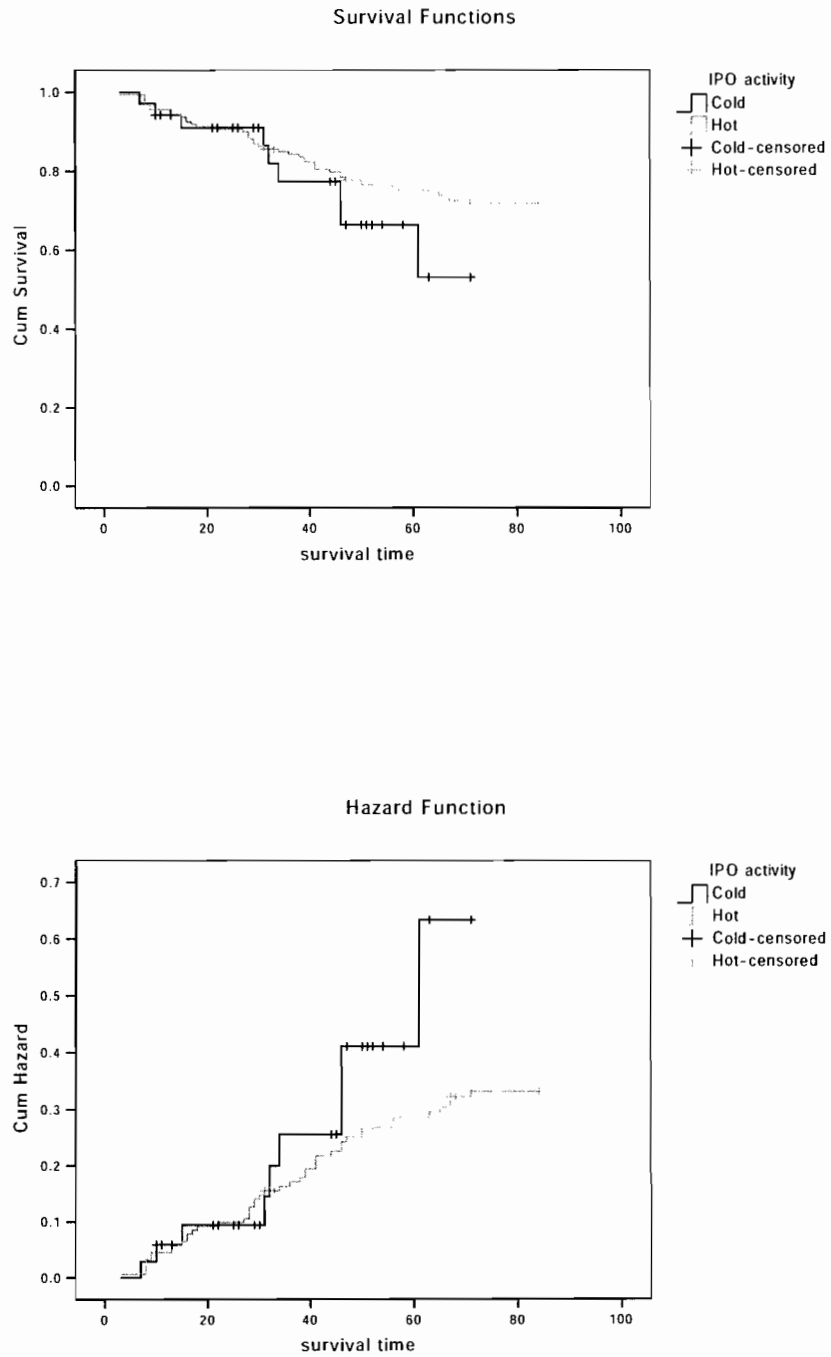


The results related to financial leverage variable show that 50.5% of firms with high total debts ratios, and 4.1% of firms with low total debts ratios are delisted during the period of study. In addition, the hazard function curve of firms with high leverage ratios is higher than the curve of those with low leverage ratios, as illustrated in Figure 5.3. That is, the probability of involuntary delisting is higher in high levered firms.

Moreover, the mean survival time is less in firms with high leverage ratios compared with the mean in those with low leverage ratios (50.674 months vs. 82.076 months). The survival function curve of firms with high leverage ratios is under the curve of firms with low leverage ratios, and the difference between the two survival functions is significant at 1% level. These results confirm that high levered firms are expected to have shorter time to delisting as reported by Li et al. (2006), among others.

There is no support for the "window of opportunity hypothesis" of Ritter (1984, 1991) and Loughran and Ritter (1995) based on the results of the IPO activity variable. The mean survival time of IPOs issued in hot years (69.733 months) is higher than the mean of IPOs issued in cold years (56.238 months). Figure 5.4 shows that the survival function curve of IPOs issued in hot years is above the curve of IPOs issued in cold years, for the most part. Nevertheless, the difference between the two survival functions is not significant. Specifically, the p-values of log rank test, Breslow test, and Tarone-Ware test are 0.298, 0.397, and 0.346, respectively. Breslow test, which has the worst p-value, is the most appropriate test in the IPO activity variable because the survival function curves cross each other.

Figure 5.4 Survival and hazard functions' curves of IPO activity variable



It is concluded from Kaplan-Meier survival analysis that the univariate determinants of delisting rate discussed in Sections 5.2.1.1 and 5.2.2.1, and those of survival time discussed in this section are identical. However, they work in opposite directions. To paraphrase, the univariate determinants that cause lower delisting rate are the same determinants that cause longer survival time. Specifically, firm's age, firm size, institutional ownership, liquidity, assets growth rate, cash coverage, operating efficiency, profitability, offering size, initial return, and insider ownership variables have significant positive relationships with survival time and significant negative relationships with survival rate.

In addition, privatized firms, firms backed by VCs, firms audited by reputable auditors, firms listed before August 2002, and those listed on the Official Schedule have longer survival time and less delisting rate compared with other firms. Furthermore, financial leverage variable has a significant negative relationship with survival time and a significant positive relationship with delisting rate. Moreover, IPO activity variable does not have significant relationship with both survival time and three-year delisting rate. However, the significance of the difference in delisting rate in hot and cold periods based on chi-square test is not reliable since there is one cell with expected frequency less than 5.

5.3.3 Cox Regression Model

5.3.3.1 Results Related to the Assumptions of Cox Regression Model

a) No multicollinearity

The VIF values of *FIRMSZ* and *OFFERSZ* variables are greater than 10 (11.21 and 12.23, respectively) in the model which includes all the 18 independent

variables examined in this study. In addition, Pearson correlation coefficient between these two variables is extremely high (0.9168). Therefore, the model which comprises all the 18 variables is not reliable due to the multicollinearity problem.

Furthermore, building a model containing all significant variables in models 1 and 2 is not recommended due to the multicollinearity problem. VIF values of *FIRMSZ* and *OFFERSZ* variables are also greater than 10 (10.66 and 11.55, respectively) in that model. As such, Model 1 in Cox regression analysis includes all variables studied without *OFFERSZ* variable, while Model 2 contains all the variables after excluding *FIRMSZ* variable. Model 3 contains all significant variables in Models 1 and 2, after excluding *OFFERSZ* variable, and Model 4 includes all significant variables in Models 1 and 2, after excluding *FIRMSZ* variable. All the four models are free from the multicollinearity problem because the VIF value of each variable is less than 10 in all models used. In addition, the absolute value of Pearson correlation coefficient for each pair of independent variables listed in these four models is less than 0.80.

b) Proportional hazards (PH)

In order to test the PH assumption, the **Schoenfeld residuals PH test** was run 22 times; as illustrated in Table 5.14, four times to test the PH assumption for the four overall models, and 18 times to test this assumption for each independent variable. Before running this test, 22 Cox proportional hazards models were generated first. To detail, 18 univariate Cox regression models were generated before running the Schoenfeld test, in addition to four multivariate Cox regression models related to the four overall models. These univariate Cox regression models give

identical conclusions compared with those obtained from Kaplan-Meier univariate analysis.

Table 5.14 shows that the PH assumption is violated in all the four models (i.e. Models 1, 2, 3, and 4). It is also not met in *VC*, *CURRENT*, *GROWTH*, *COVERAGE*, *TURNOVER*, *QLAUDIT*, and *ALPHA* variables. That is, these seven variables interact with time. Therefore, Cox proportional hazards model is not appropriate for fitting the data in this study, and Cox nonproportional hazards model should be used instead.

Table 5.14 Testing the PH assumption based on the Schoenfeld residuals PH test

Models	χ^2	<i>P-value</i>	PH Assumption Status
Model 1	297.93	0.000	Rejected
Model 2	291.48	0.000	Rejected
Model 3	208.95	0.000	Rejected
Model 4	185.45	0.000	Rejected
FIRMAGE	0.32	0.571	Accepted
FIRMSZ	1.02	0.314	Accepted
FRMTYPE	0.26	0.612	Accepted
INSTITUTE	0.21	0.644	Accepted
VC	5.25	0.022	Rejected
LEVERAGE	0.88	0.348	Accepted
CURRENT	22.45	0.000	Rejected
GROWTH	7.83	0.005	Rejected
COVERAGE	14.39	0.000	Rejected
TURNOVER	21.26	0.000	Rejected
ROE	1.06	0.304	Accepted
OFFERSZ	0.69	0.406	Accepted
ACTIVITY	0.84	0.360	Accepted
QLAUDIT	10.67	0.001	Rejected
INITIAL	1.00	0.318	Accepted
ALPHA	28.58	0.000	Rejected
RULES	0.38	0.538	Accepted
SCHEDULE	0.23	0.633	Accepted

Two methods are commonly used in Cox nonproportional hazards model, namely the stratified Cox regression method and Cox regression with time varying covariates method. The stratified Cox regression method requires the variables that

interact with time to be categorical and not of direct interest to the researcher (Allison, 2004; Kleinbaum & Klein, 2005). However, all time varying variables (i.e., *VC*, *CURRENT*, *GROWTH*, *COVERAGE*, *TURNOVER*, *QLAUDIT*, and *ALPHA*) are of direct interest to the researcher. Moreover, not all time varying variables are categorical. Specifically, *CURRENT*, *GROWTH*, *COVERAGE*, *TURNOVER*, and *ALPHA* are continuous variables. Therefore, the stratified Cox regression method could not be used in this study, and Cox regression with time varying covariates method is used instead.

Further testing of the PH assumption was done through Cox regression model with time dependent covariates. The seven pre-determined time dependent covariates from the Schoenfeld test are: *VC*, *CURRENT*, *GROWTH*, *COVERAGE*, *TURNOVER*, *QLAUDIT* and *ALPHA* variables. The hazard ratios and p-values of these seven variables in models 1, 2, 3, and 4 are presented in Table 5.15. *COVERAGE* variable is not significant in Models 2 and 4, while *VC* and *QLAUDIT* variables are not significant in Models 1 and 2. The insignificance of these three variables means that their interaction term with time is not significant. That is, these three variables are not significantly associated with time. Thus, the PH assumption is still accepted for *Coverage* variable in Models 2 and 4. It is also accepted for *VC* and *QLAUDIT* variables in Models 1 and 2. Therefore, the final time dependent variables are *CURRENT*, *GROWTH*, *COVERAGE* (in Models 1 and 3), *TURNOVER* and *ALPHA*.

Table 5.15 Testing the PH assumption through Cox regression model with time dependent covariates based on the Efron method for ties and robust standard error

Interaction terms with time	Model 1	Model 2	Model 3	Model 4
	Hazard Ratio (p-value)	Hazard Ratio (p-value)	Hazard Ratio (p-value)	Hazard Ratio (p-value)
T_VC	0.956 (0.293)	0.948 (0.217)		
T_CURRENT	1.056 ^{***} (0.010)	1.058 ^{**} (0.015)	1.065 ^{**} (0.028)	1.057 [*] (0.077)
T_GROWTH	1.003 ^{***} (0.002)	1.003 ^{***} (0.001)	1.003 ^{***} (0.000)	1.003 ^{***} (0.000)
T_COVERAGE	1.003 [*] (0.087)	1.003 (0.159)	1.003 [*] (0.069)	1.002 (0.113)
T_TURNOVER	1.071 ^{***} (0.000)	1.067 ^{***} (0.003)	1.067 ^{***} (0.000)	1.061 ^{***} (0.000)
T_QLAUDIT	1.093 (0.404)	1.089 (0.409)		
T_ALPHA	1.004 ^{**} (0.000)	1.004 ^{**} (0.000)	1.003 ^{***} (0.000)	1.003 ^{***} (0.000)

Note ***, ** and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

5.3.3.2 The Results of the Four Cox Regression Models

The exact methods are not allowed in Cox regression with time dependent covariates to deal with tied survival times. In addition, Guo (2010), among others, recommends the Efron method to deal with ties in Cox regression. Therefore, the Efron method is the method employed in this study to deal with tied survival times. Table 5.16 summarizes the results of the four Cox regression models based on robust standard error and the Efron method for ties. The Wald χ^2 values are 139.33, 160.01, 128.06, and 147.76 in Models 1, 2, 3, and 4, respectively. All these models have an overall significance at the 1% level based on Wald test with p-value equals 0.000 in each model. Model 2 is the best model based on Wald test because it has the highest Wald χ^2 value. Thus, the results of significant variables in Model 2 are detailed in the following sections.

Table 5.16 Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on robust standard error and Efron method for ties

Variables	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$) ²³	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
FIRIMAGE	0.000 (0.973)	1.000 (0.005%)	0.000 (0.914)	1.000 (0.014%)	-0.243** (0.000)	0.784 (-21.6%)	-0.029*** (0.000)	0.972 (-2.8%)
FIRMSZ	-0.294*** (0.001)	0.745 (-25.5%)						
FRMTYPE	-0.692 (0.421)	0.501	-0.615 (0.464)	0.541				
INSTITUTE	-0.025*** (0.000)	0.975 (-2.5%)	-0.025*** (0.000)	0.976 (-2.4%)	-0.029*** (0.000)	0.971 (-2.9%)	-0.029*** (0.000)	0.972 (-2.8%)
VC	0.331 (0.583)	1.393	0.201 (0.742)	1.222				
LEVERAGE	0.034 (0.225)	1.035 (3.5%)	0.034 (0.213)	1.034 (3.4%)				
CURRENT	-3.712** (0.016)	0.024 (-97.6%)	-3.884** (0.011)	0.021 (-97.9%)	-4.547*** (0.002)	0.011 (-98.9%)	-4.245*** (0.003)	0.014 (-98.6%)
GROWTH	-0.220*** (0.000)	0.802 (-19.8%)	-0.223*** (0.000)	0.8 (-20%)	-0.213*** (0.000)	0.808 (-19.2%)	-0.213*** (0.000)	0.808 (-19.2%)
COVERAGE	-0.258** (0.024)	0.773 (-22.7%)	-0.037 (0.135)	0.964 (-3.6%)	-0.220** (0.035)	0.802 (-19.8%)	-0.048** (0.039)	0.954 (-4.6%)
TURNOVER	-4.477*** (0.000)	0.011 (-98.9%)	-4.144*** (0.000)	0.016 (-98.4%)	-4.316*** (0.000)	0.013 (-98.7%)	-4.109*** (0.000)	0.016 (-98.4%)
ROE	-0.012 (0.219)	0.988 (-1.2%)	-0.017* (0.070)	0.983 (-1.7%)	-0.021** (0.019)	0.979 (-2.1%)	-0.025*** (0.004)	0.976 (-2.4%)
OFFERSZ			-0.285*** (0.000)	0.752 (-24.8%)			-0.248*** (0.000)	0.78 (-2.2%)
ACTIVITY	-1.493** (0.046)	0.225	-1.238* (0.076)	0.290	-0.949** (0.017)	0.387	-0.975** (0.011)	0.377

²³ The percentage change in the hazard rate ($h_i(t) = 100 * (\text{hazard ratio} - 1)$). It is applicable only on continuous variables (Der and Everitt, 2002; Jain and Martin Jr, 2005).

Table 5.16 (continued) Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on robust standard error and Efron method for ties

Variables	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$) ²³	Coefficient (p-value)	Hazard Ratio Change in $h_i(t)$	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
QLAUDIT	-0.811 (0.255)	0.444	-0.787 (0.195)	0.455	-0.029*** (0.003)	0.972 (-2.8%)	-0.032*** (0.000)	0.969 (-3.1%)
INITIAL	-0.028** (0.018)	0.973 (-2.7%)	-0.030*** (0.002)	0.970 (-3%)	-0.029*** (0.003)	0.972 (-2.8%)	-0.032*** (0.000)	0.969 (-3.1%)
ALPHA	-0.225*** (0.000)	0.798 (-20.2%)	-0.227*** (0.000)	0.797 (-20.3%)	-0.178*** (0.000)	0.837 (-16.3%)	-0.180*** (0.000)	0.836 (-16.4%)
RULES	-0.933 (0.174)	0.394	-0.554 (0.366)	0.575	-0.000 (0.000)	0.000	-0.000 (0.000)	0.000
SCHEDULE	-0.904 (0.169)	0.405	-1.081 (0.101)	0.339	0.000	0.000	0.000	0.000
T_CURRENT	0.054** (0.029)	1.055 (5.5%)	0.057* (0.060)	1.059 (5.9%)	0.063** (0.028)	1.065 (6.5%)	0.054* (0.098)	1.056 (5.6%)
T_GROWTH	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)
T_COVERAGE	0.004** (0.039)	1.004 (0.4%)	0.003* (0.069)	1.003 (0.3%)	0.003* (0.069)	1.003 (0.3%)	0.003* (0.069)	1.003 (0.3%)
T_TURNOVER	0.064*** (0.000)	1.066 (6.6%)	0.058*** (0.001)	1.060 (6%)	0.064*** (0.000)	1.067 (6.7%)	0.061*** (0.000)	1.063 (0.3%)
T_ALPHA	0.004*** (0.000)	1.004 (0.4%)	0.004*** (0.000)	1.004 (0.4%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)
Wald test χ^2 (p-value)	139.33*** (0.000)		160.01*** (0.000)		128.06*** (0.000)		147.76*** (0.000)	

Note: ***, ** and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

Table 5.16 shows that there are eleven independent variables have significant relationships with survival time. All these significant variables have negative signs. More specifically, nine predictors have significant positive relationships with survival time in all models employed, namely *FIRMSZ*, *INSTITUTE*, *CURRENT*, *GROWTH*, *TURNOVER*, *OFFERSZ*, *ACTIVITY*, *INITIAL*, and *ALPHA* variables. In addition, *COVERAGE* variable is significant in all models fitted except in Model 2, and *ROE* variable is only significant in Models 2, 3 and 4. *T_CURRENT*, *T_GROWTH*, *T_COVERAGE*, *T_TURNOVER*, and *T_ALPHA* variables represent the interaction term between *CURRENT*, *GROWTH*, *COVERAGE*, *TURNOVER*, and *ALPHA* variables, respectively, and time. Since all these interaction term variables are statistically significant, Cox proportional hazard model is no longer suitable, and Cox nonproportional hazard model is used instead, as mentioned earlier.

Although Cox regression model is a survival time model, its dependent variable is the hazard rate not the survival time as in the accelerated failure time (AFT) model. Therefore, the negative (positive) sign of the independent variable's coefficient means that the hazard rate will decrease (increase) with the increase in the independent variable, and the survival time will increase (decrease) accordingly (Allison, 2009; Garson, 2010). In addition, unlike the AFT model, there is no intercept in the Cox regression model (Goot et al., 2009). In the remainder of this section, the significant time independent variables in Table 5.16 are discussed followed by the significant time dependent variables. The discussion of these variables highlights the effect of each variable on the probability of delisting and survival time.

A) Firstly, time independent variables:

a) Firm size

Firm size (*FIRMSZ*) variable associates negatively with the hazard rate and positively with the survival time at 1% significance level in Models 1 and 3 (p-values equal 0.001 and 0.000, respectively, and beta coefficients equal -0.294 and -0.243, respectively). *FIRMSZ* variable is in the log form. Thus, the value of -0.294 in Model 1 means that a decrease of 0.294% in the involuntary delisting rate occurring for a 1% increase in firm size (i.e., market capitalization adjusted by the CPI), all other things being constant. This result confirms the argument of the resource-based theory that larger firms have the resources to withstand any problems in investment strategy compared with smaller firms (Hensler et al., 1997; Esteve-Pérez & Mañez-Castillejo, 2008). It is also consistent with the results obtained from Kaplan-Meier univariate analysis.

b) Institutional ownership

The results related to institutional ownership variable confirm the results obtained from the univariate analysis that there is positive relationship between institutional ownership and survival time at 1% significance level (p-value = 0.000 in each model). These results are in line with the efficient monitoring hypothesis of Pound (1988). More specifically, the percentages of change in the hazard rate equal -2.5%, -2.4%, -2.9%, and -2.8% in Models 1, 2, 3, and 4, respectively. The -2.4% in Model 2 means that there is a 2.4% decrease in the rate of involuntary delisting for a 1% increase in the *INSTITUTE* variable, ceteris paribus.

c) Return on equity (ROE)

The coefficients of return on equity (ROE) variable, as a measure of profitability, are negative and their hazard ratios are less than one. Therefore, ROE has the expected positive relationship with survival time. This result supports the results of the Kaplan-Meier analysis, the resource-based theory, and the findings of Jain and Kini (2008), among others. This relationship is statistically significant at 10%, 5%, and 1% levels in Models 2, 3, and 4, respectively (p-values are 0.070, 0.019 and 0.004, respectively). The percentage change in the hazard rates in Models 2, 3 and 4 are -1.7%, -2.1% and -2.4%, respectively. The percentage of -1.7% in Model 2 means that there is a 1.7% decrease in the rate of involuntary delisting for a one unit (1%) increase in the ROE variable, holding other predictors constant.

d) Offering size

The results related to offering size variable (*OFFERSZ*) are consistent with both the univariate survival analyses and the resource-based theory. They also confirm the studies of Hensler et al. (1997), Jain and Martin Jr (2005), Kooli and Meknassi (2007), and Jain and Kini (2008), among others, who report that the larger the offer size, the better the survival profile of an IPO firm. More specifically, the coefficients of *OFFERSZ* variable in Models 2 and 4 (-0.285 and -0.248, respectively) are negative with 0.000 p-value. So, the hazard ratios are less than one (0.752 and 0.780, respectively). Since *OFFERSZ* variable is in the log form, the value of -0.285 in Model 2 means that 1% increase in the offering size (i.e., gross proceeds adjusted by the CPI) would lead to 0.285% decrease in the involuntary delisting rate, holding all other things constant.

e) IPO activity

IPO activity (*ACTIVITY*) variable has a significant negative relationship with the hazard rate in all models employed (p-values are 0.046, 0.076, 0.017, and 0.011 in Models 1, 2, 3, and 4, respectively). More specifically, all the hazard ratios of IPO activity variable are less than one (0.225, 0.290, 0.387, and 0.377 in Models 1, 2, 3, and 4 respectively). The hazard ratio of 0.290 in Model 2 means that the IPO firm which issued its IPO in hot issue year and survived until a given time has 29% of the involuntary delisting rate from the firm which issued its IPO in cold issue year. Therefore, firms issuing their IPOs in hot issue years survive more than those issuing their IPOs in cold issue years.

This negative relationship between the IPO activity variable and the hazard rate contradicts the "window of opportunity hypothesis" of Ritter (1984, 1991) and Loughran and Ritter (1995). Nevertheless, this relationship could be attributed to issuing most established, well-known and privatization IPOs in hot issue periods.

f) Initial return

Initial return variable has negative relationship with the hazard (involuntary delisting) rate. This relationship is statistically significant at 5% level in Model 1 (P-value = 0.018), and 1% in the three other models (p-values are 0.002, 0.003, and 0.000 in Models 2, 3, and 4, respectively). The percentage change in the hazard rate in Models 1, 2, 3, and 4 are -2.7%, -3%, -2.8% and -3.1%, respectively. The percentage -3% in Model 2 means that there is a 3% decrease in the rate of

involuntary delisting for a one unit (1%) increase in the *INITIAL* variable after controlling for all other variables in the model.

The previous results support Kaplan-Meier univariate analysis. They are also consistent with the signaling hypothesis of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) which considers underpricing as a signal of the firm's quality. In addition, these results are in line with the marketing event hypothesis of Chemmanur (1993) and Demers and Lewellen (2003) which regards it as a means for firm's publicity. The empirical evidence of Hensler et al. (1997) and Boubakri et al. (2005), who report a positive relationship between initial return and survival time, is also supported.

B) Secondly, time dependent variables:

CURRENT, *GROWTH*, *COVERAGE*, *TURNOVER*, and *ALPHA* are the time dependent variables in this study. Table 5.16 shows that these variables have significant negative relationships with the hazard rate (i.e., the probability of involuntary delisting). However, the interactions between these variables and time have positive significant relationships with it. That is, the negative relationships between *CURRENT*, *GROWTH*, *COVERAGE*, *TURNOVER*, and *ALPHA* with the hazard rate become weaker with the passage of time until its end at a given point of time. After that point, the relationships become steadily positive.

a) Liquidity

Current ratio (*CURRENT*) has the expected negative relationship with the hazard rate in all models employed. Specifically, the regression coefficients of *CURRENT* variable are -3.712, -3.884, -4.547, and -4.245 in Models 1, 2, 3, and 4, respectively. This result is consistent with the results of Kaplan-Meier univariate analysis and supports the argument of Beaver et al. (1970) and Abdelghany (2005) that high liquidity position prevents the firm from any unexpected financial problems. It also confirms the resource-based theory. However, this relationship is not constant over time because the interaction term between *CURRENT* variable and time (*CURRENT_T*) has significant positive association with the hazard rate.

The log hazard rate of *CURRENT* variable relies not only on the coefficient of *CURRENT* variable, but also on both the coefficient of the interaction term between *CURRENT* variable and time (*T_CURRENT*) and the value of time (*t*). In Model 2, the log hazard rate will change by $(-3.884 + 0.057t)$ for each unit increase in *CURRENT*; as illustrated in Equation 4.7 in Chapter 4. The time (*t*) equals zero at the starting date of survival time (in this study, the starting date of survival time is the listing date for firms listed on August 2002 onwards, and September, 1 2003 for firms listed before August 2002). Thus, the change in log hazard rate is -3.884 of *CURRENT* at time zero; however this negative relationship becomes weaker with the passage of time where it ends when *t* equals 68 months²⁴. Then, the relationship becomes positive (Allison, 2004, 2009; Kleinbaum and Klein, 2005).

²⁴ The 68 months calculated as $[-(\text{The coefficient of current variable}) / \text{the coefficient of the interaction term}] = 3.884 / 0.057$.

b) Growth rate in total assets

At the starting date of survival time, *GROWTH* variable has a significant negative relationship at 1% level (p-value = 0.000) with the hazard rate in all models employed. Based on the results of Model 2, a one unit (1%) increase in *GROWTH* variable leads to a 20% decrease in the probability of involuntary delisting (hazard rate) at the beginning date of survival time. In other words, firms with higher growth rate are expected to survive longer. This result is supportive to both the results obtained from Kaplan-Meier survival analysis, and the resource-based theory. However, the interaction term (*T_GROWTH*) has a significant positive relationship with the hazard rate (p-value = 0.000). These findings suggest that the negative relationship between *GROWTH* and the hazard rate weakens over time until it vanishes nearly after 74 survival months, after which, the relationship becomes positive.

c) Cash coverage ratio

Table 5.16 indicates that the interaction term between *COVERAGE* variable and time (*T_COVERAGE*) is significant in Models 1 and 3. Therefore, this variable is treated as a time dependent variable in these two models, and as a time independent variable in Models 2 and 4. In addition, *COVERAGE* variable has a significant negative relationship with the hazard rate at 5% level based on the results of Models 1, 3 and 4 (p-values equal 0.024, 0.035, and 0.039, respectively). The regression coefficient of -0.048 in Model 4 means that a one unit increase in *COVERAGE* variable would lead to a 0.048 decrease in the log hazard rate. This result is consistent with the results of Kaplan-Meier univariate analysis that cash coverage

ratio variable has a significant positive relationship with survival time. It also supports the resource-based theory.

The coefficients of *COVERAGE* variable in Models 1 and 3, however, are interpreted differently because this variable is time-dependent in these two models. For instance, the change in the log hazard rate in Model 1 for one unit change in the *COVERAGE* variable equals $-0.258 + 0.004t$. That is, there is a significant negative relationship between *COVERAGE* variable and the log hazard rate at the starting survival time. This negative relationship weakens over time until its end after 64.5 months (i.e., $0.258 / 0.004$). Then, the relationship becomes positive.

d) Operating efficiency

Assets turnover ratio (*TURNOVER*) is the measure of operating efficiency used in the present study. Table 5.16 shows that *TURNOVER* variable has the expected negative relationship with the probability of involuntary delisting at 1% level in all models used (p-value = 0.000) at the beginning date of survival time. This result is consistent with the results of Kaplan-Meier univariate analysis, and confirms the expected positive relationship between *TURNOVER* variable and survival time. It also supports the resource-based theory. The results of Model 2 show that the hazard rate decreases by 98.4% for a one unit increase in the *TURNOVER* variable at the starting date of survival time. However, with the passage of time this negative relationship becomes less strong than before until its end approximately after 71 survival months. Then, the relationship becomes positive.

e) Insider ownership

Table 5.16 indicates that the relationship between the percentage of insider ownership (*ALPHA*) and the hazard rate is significantly negative. Specifically, the coefficients of *ALPHA* in Models 1, 2, 3 and 4 equal -0.225, -0.227, -0.178, and -0.180, respectively. These coefficients are significant at the 1% level (p-value is 0.000 in each model). Therefore, the survival profile is better in firms with higher insider ownership. This result is in line with the signaling hypothesis of Leland and Pyle (1977) and Grinblatt and Hwang (1989), and the agency cost hypothesis of Jensen and Meckling (1976). It is also consistent with the Kaplan-Meier univariate analysis and confirms the empirical evidence from the studies of Hensler et al. (1997), Jain and Kini (2000, 2008) and Goot et al. (2009).

The results of Model 2 in Table 5.16 show that there is a 20.3% decrease in the probability of involuntary delisting for a one unit (1%) increase in *ALPHA* at the first date of survival time. However, the interaction term between alpha and time (*T_ALPHA*) has a significant positive relationship with the hazard rate at the 1% level (the coefficient of *T_ALPHA* equals 0.004 with 0.000 p-value). Therefore, the relationship between *ALPHA* and the hazard rate weakens over time. Moreover, after the passage of nearly 57 months from the starting date of survival time, the relationship between *ALPHA* and the hazard rate disappears. Then, the relationship becomes positive.

5.3.3.3 Robustness Checks on Cox Nonproportional hazards Models

The four Cox nonproportional hazard models employed in this study relies on the Efron method for ties and the robust standard error method. In this section, the robustness of results is checked by three additional model specifications. Firstly, the Breslow method for ties is used instead of the Efron method. Secondly, the default standard error is used in lieu of the robust standard error. Thirdly, both the Efron method for ties and the robust standard error method are employed but after using the raw survival time as the time variable. These three additional models are detailed as follows:

a) Using Breslow Method for Ties

Table 5.17 presents the four Cox nonproportional hazard models based on the Breslow method for ties. By comparing these results with the results obtained from the Efron method presented in Table 5.16, it is evident that the results are quite similar. To detail, each model has an overall significance of 0.000 p-value based on Wald test. In addition, all significant variables based on the Efron method are also significant based on the Breslow method. The coefficients in each model based on the Breslow method have the same signs and, in most cases, the same significance levels compared with their counterparts based on the Efron method. Although, schedule type (*SCHEDULE*) variable is significant based on the Breslow method only (in Models 2 and 4), it is significant at 10% level (p-values in Models 2 and 4 are 0.087 and 0.088, respectively). Therefore, it could be concluded that the method chosen to handle tied survival times does not significantly affect Cox regression results in this study.

Table 5.17 Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on robust standard error and Breslow method for ties

Variables	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
FIRMAGE	0.000 (0.999)	1.000 (0)	0.000 (0.941)	1.000 (0.009%)	-0.234*** (0.001)	0.791 (-20.9%)		
FIRMSZ	-0.296*** (0.000)	0.743 (-25.7%)						
FRMTYPE	-0.605 (0.461)	0.546	-0.524 (0.514)	0.592				
INSTITUTE	-0.023*** (0.000)	0.977 (-2.3%)	-0.022*** (0.000)	0.978 (-2.2%)	-0.025*** (0.000)	0.975 (-2.5%)	-0.024*** (0.000)	0.976 (-2.4%)
VC	0.346 (0.553)	1.413	0.214 (0.719)	1.238				
LEVERAGE	0.035 (0.200)	1.036 (3.6%)	0.034 (0.188)	1.035 (3.5%)				
CURRENT	-3.299** (0.028)	0.037 (-96.3%)	-3.488** (0.022)	0.031 (-96.9%)	-4.458*** (0.001)	0.012 (-98.8%)	-4.247*** (0.001)	0.014 (-98.6%)
GROWTH	-0.205*** (0.000)	0.815 (-18.5%)	-0.206*** (0.000)	0.814 (-18.6%)	-0.211*** (0.000)	0.810 (-19%)	-0.212*** (0.000)	0.809 (-19.1%)
COVERAGE	-0.251** (0.025)	0.778 (-22.2%)	-0.037 (0.127)	0.964 (-3.6%)	-0.202** (0.041)	0.817 (-18.3%)	-0.041** (0.049)	0.960 (-4%)
TURNOVER	-4.214*** (0.000)	0.015 (-98.5%)	-3.885*** (0.000)	0.021 (-97.9%)	-4.359*** (0.000)	0.013 (-98.7%)	-4.221*** (0.000)	0.015 (-98.5%)
ROE	-0.011 (0.257)	0.989 (-1.07%)	-0.016* (0.082)	0.984 (-1.6%)	-0.016* (0.067)	0.984 (-1.6%)	-0.020** (0.017)	0.980 (-2%)
OFFERSZ			-0.284*** (0.000)	0.753 (-24.7%)			-0.243*** (0.000)	0.785 (-21.5%)
ACTIVITY	-1.436** (0.048)	0.238	-1.185* (0.080)	0.306	-0.707* (0.069)	0.493	-0.714* (0.058)	0.490
QLAUDIT	-0.777 (0.260)	0.460	-0.738 (0.210)	0.478				
INITIAL	-0.028** (0.028)	0.972	-0.031*** (0.001)	0.97	-0.028*** (0.001)	0.972	-0.031*** (0.001)	0.969

Table 5.17 (continue) Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on robust standard error and Breslow method for ties

Variables	Model 1			Model 2			Model 3			Model 4		
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
ALPHA	0.048** (0.013)	1.049 (-2.8%)	0.051* (0.001)	1.053 (-3%)	0.009*** (0.001)	1.065 (-2.8%)	0.057 (0.000)	1.059 (-3.1%)	0.063*** (0.000)	1.066 (-16.7%)	0.057 (0.055)	1.059 (5.9%)
RULES	-0.217*** (0.000)	0.805 (-19.5%)	-0.217*** (0.000)	0.805 (-19.5%)	-0.177*** (0.000)	0.837 (-16.3%)	-0.183*** (0.000)	0.833 (-16.7%)	-0.183*** (0.000)	0.833 (-16.7%)	-0.183*** (0.000)	0.833 (-16.7%)
SCHEDULE	-0.988 (0.142)	0.373	-1.103* (0.318)	0.332	-0.962 (0.120)	-0.975 (-61.8%)	-1.079* (0.088)	0.340	-1.079* (0.088)	0.340	-1.079* (0.088)	0.340
T_CURRENT	0.048** (0.050)	1.049 (4.9%)	0.051* (0.092)	1.053 (5.3%)	0.009*** (0.047)	1.065 (6.5%)	0.057 (0.055)	1.059 (5.9%)	0.063*** (0.000)	1.066 (6.5%)	0.057 (0.055)	1.059 (5.9%)
T_GROWTH	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)
T_COVERAGE	0.004** (0.041)	1.004 (0.4%)	0.004** (0.041)	1.004 (0.4%)	0.003* (0.082)	1.003 (0.3%)	0.003* (0.082)	1.003 (0.3%)	0.003* (0.082)	1.003 (0.3%)	0.003* (0.082)	1.003 (0.3%)
T_TURNOVER	0.060*** (0.000)	1.062 (6.2%)	0.054*** (0.001)	1.056 (5.6%)	0.061*** (0.000)	1.067 (6.7%)	0.063*** (0.000)	1.066 (6.5%)	0.063*** (0.000)	1.066 (6.5%)	0.063*** (0.000)	1.066 (6.5%)
T_ALPHA	0.004** (0.000)	1.004 (0.4%)	0.004** (0.000)	1.004 (0.4%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)
Wald test χ^2 (p-value)	141.16*** (0.000)		162.94*** (0.000)		153.39*** (0.000)		169.37*** (0.000)		169.37*** (0.000)		169.37*** (0.000)	

Note: ***, **, and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

b) Using the Default Standard Error Method

Table 5.18 presents the results of Cox regression models based on the default standard error and the Efron method for ties. The coefficients in Models 1 and 2 in this table are identical to those listed in Table 5.16; however p-values are not the same. There are some similarities between the results presented in Tables 5.16 and 5.18. More specifically, the four overall models in these tables are accepted with the same p-values (0.000) based on LR test²⁵. In addition, all significant variables, except ROE variable, based on the robust standard error method are also significant when the default standard error method is used. The coefficients in each model based on the default standard error method have the same signs and, in most cases, the same significance levels compared with their counterparts based on the robust standard error method. However, there are some differences among the results of *COVERAGE*, *ROE*, *ACTIVITY*, and *SCHEDULE* variables in these two methods.

To detail, *COVERAGE* variable is significant in Models 1, 3, and 4 based on the results of the robust standard error method; as illustrated in Table 5.16. However, it is only significant in Models 1 and 3 based on the results of the default standard error; as shown in Table 5.18. Furthermore, *ROE* variable is significant in Models 2, 3, and 4 in Table 5.16, and not significant at any model in Table 5.18.

²⁵ To check the significance of the overall model based on Stata software, Wald test is the test employed when using robust standard error. However, LR test is the test used when employing default standard error.

Table 5.18 Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on default standard error and Efron method for ties

Variables	Model 1			Model 2			Model 3			Model 4		
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio Change in $h_i(t)$ 1.000	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
FIRMAGE	0.000 (0.966)	1.000 (0.005%)	0.0001 (0.897)	1.000 (0.014%)								
FIRMSZ	-0.294*** (0.001)	0.745 (-25.5%)										
FRMTYPE	-0.692 (0.278)	0.501	-0.615 (0.342)	0.541								
INSTITUTE	-0.025*** (0.000)	0.975 (-2.5%)	-0.025*** (0.000)	0.976 (-2.43%)								
VC	0.331 (0.580)	1.393	0.201 (0.739)	1.222								
LEVERAGE	0.034 (0.109)	1.035 (3.5%)	0.034 (0.109)	1.034 (3.4%)								
CURRENT	-3.712*** (0.008)	0.024 (-97.6%)	-3.884*** (0.006)	0.021 (-97.9%)								
GROWTH	-0.220*** (0.000)	0.802 (-19.8%)	-0.223*** (0.000)	0.8 (-20%)								
COVERAGE	-0.258** (0.050)	0.773 (-22.7%)	-0.037 (0.260)	0.964 (-3.6%)								
TURNOVER	-4.477*** (0.001)	0.011 (-98.9%)	-4.144*** (0.001)	0.016 (-98.4%)								
ROE	-0.012 (0.334)	0.988 (-1.2%)	-0.017 (0.156)	0.983 (-1.7%)								
OFFERSZ			-0.285*** (0.000)	0.752 (-24.8%)								
ACTIVITY	-1.493** (0.046)	0.225	-1.238* (0.087)	0.29								
QLAUDIT	-0.811 (0.136)	0.444	-0.787 (0.135)	0.455								
INITIAL	-0.028** (0.012)	0.973 (-2.7%)	-0.030*** (0.005)	0.97 (-3%)								
ALPHA	-0.225*** (0.000)	0.798 (-20.2%)	-0.227*** (0.000)	0.797 (-20.3%)								

Table 5.18 (continued) Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on default standard error and Efron method for ties

Variables	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
RULES	-0.933 (0.219)	0.394	-0.554 (0.428)	0.575	-0.990* (0.056)	0.372	-1.095** (0.034)	0.334
SCHEDULE	-0.904 (0.117)	0.405	-1.081* (0.069)	0.339				
T_CURRENT	0.054** (0.043)	1.055 (5.5%)	0.057* (0.053)	1.059 (5.89%)	0.071*** (0.005)	1.074 (7.4%)	0.064** (0.022)	1.066 (6.6%)
T_GROWTH	0.003*** (0.001)	1.003 (0.3%)	0.003*** (0.001)	1.003 (0.3%)	0.003*** (0.001)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)
T_COVERAGE	0.004 (0.071)	1.004 (0.4%)	0.004 (0.071)	1.004 (0.4%)	0.003* (0.081)	1.003 (0.3%)		
T_TURNOVER	0.064*** (0.003)	1.066 (6.6%)	0.058*** (0.007)	1.060 (6%)	0.070*** (0.001)	1.072 (7.2%)	0.070*** (0.001)	1.072 (7.2%)
T_ALPHA	0.004*** (0.000)	1.004 (0.4%)	0.004*** (0.000)	1.004 (0.4%)	0.003*** (0.000)	1.003 (0.3%)	0.003*** (0.000)	1.003 (0.3%)
LR test χ^2	283.13		280.33		272.46		269.77	
(P-value)	(0.000)		(0.000)		(0.000)		(0.000)	

Note: ***, **, * and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

Although *ACTIVITY* variable is significant in all models used based on the robust standard error method, it is only significant in the first two models based on the default standard error method. Moreover, *SCHEDULE* variable is significant in Models 2, 3, and 4 based on the default standard error method only.

Overall, the results of Cox regression models are quite robust to the method used for dealing with ties. These results are also robust, but to a less extent, to the method employed to estimate standard errors. This is because all significant variables in Table 5.16, except *ROE* variable, are also significant at least in one model in Tables 5.17 and 5.18. Nevertheless, there are some differences that support using the Efron method for ties and the robust standard errors because they are the recommended methods by many authors (e.g., Garson, 2010; Guo, 2010) in Cox nonproportional hazards regression models.

c) Using Raw Survival Time (*stime*) as the Time Variable

Raw survival time (*stime*) is defined as the listing period (Boubakri et al., 2005; Li et al., 2006; Kooli & Meknassi, 2007). This definition does not take into consideration the enforcement date of the new Egyptian listing rules issued on August 2002; as detailed in Chapter 4. Table 5.19 presents the results of the four Cox regression models employed using raw survival time as the time variable (*stime*). However, Tables 5.16, 5.17, and 5.18 take into account the enforcement date in defining survival time (*astime*). Both 5.16 and 5.19 tables rely on the Efron method of ties and the robust standard error method.

Table 5.19 Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on raw survival time (*stime*) as the time variable

Variables	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
FIRMAGE	-0.001 (0.714)	0.999 (-0.1%)	0.000 (0.808)	1.000 (-0.04%)	-0.364*** (0.000)	0.695 (-30.5%)		
FIRMSZ	-0.366*** (0.000)	0.693 (-30.6%)						
FRMTYPE	-0.253 (0.713)	0.776	0.024 (0.973)	1.025				
INSTITUTE	-0.016*** (0.002)	0.985 (-1.5%)	-0.014*** (0.007)	0.986 (-1.4%)	-0.017*** (0.000)	0.984 (-1.6%)	-0.015*** (0.002)	0.985 (-1.5%)
VC	1.001** (0.044)	2.722	1.054** (0.035)	2.868	0.838* (0.093)	2.311	0.790 (0.120)	2.203
LEVERAGE	0.021 (0.230)	1.021 (2.1%)	0.018 (0.297)	1.019 (1.9%)				
CURRENT	-0.304 (0.415)	0.738 (-26.2%)	-0.335 (0.320)	0.715 (-28.5%)				
GROWTH	-0.032** (0.017)	0.969 (-3.1%)	-0.032** (0.011)	0.968 (-3.2%)	-0.039*** (0.002)	0.962 (-3.8%)	-0.037*** (0.002)	0.964 (-3.6%)
COVERAGE	-0.027* (0.065)	0.973 (-2.7%)	-0.025* (0.097)	0.975 (-2.5%)	-0.042*** (0.002)	0.959 (-4.1%)	-0.041*** (0.001)	0.96 (-33.7%)
TURNOVER	-0.901*** (0.003)	0.406 (-59.4%)	-0.871*** (0.001)	0.418 (-58.2%)	-0.950*** (0.000)	0.387 (-61.3%)	-0.844*** (0.000)	0.43 (-4%)
ROE	0.001 (0.902)	1.001 (0.1%)	0.002 (0.860)	1.002 (0.2%)				
OFFERSZ			-0.406*** (0.000)	0.667 (-33.4%)			-0.411*** (0.000)	0.663 (-57%)
ACTIVITY	-0.769 (0.304)	0.463						
QLAUDIT	-0.544 (0.310)	0.580	-0.666 (0.404)	0.514				

Table 5.19 (continued) Coefficient and hazard ratio estimates from Cox nonproportional hazards models based on raw survival time (*stime*) as the time variable

Variables	Model 1		Model 2		Model 3		Model 4	
	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)	Coefficient (p-value)	Hazard Ratio (% Change in $h_i(t)$)
INITIAL	-0.026*** (0.003)	0.975 (-2.5%)	-0.034*** (0.000)	0.967 (-3.3%)	-0.030*** (0.000)	0.97 (-3%)	-0.036*** (0.000)	0.965 (-3.6%)
ALPHA	-0.094*** (0.000)	0.910 (-9%)	-0.096*** (0.000)	0.908 (-9.2%)	-0.091*** (0.000)	0.913 (-8.7%)	-0.099*** (0.000)	0.906 (-9.4%)
RULES	7.279*** (0.000)	1450.000	7.536*** (0.000)	1875.000	7.324*** (0.000)	1517.000	7.654*** (0.000)	2109.000
SCHEDULE	-1.412** (0.013)	0.244	-1.747*** (0.006)	0.174	-1.404*** (0.001)	0.246	-1.548*** (0.002)	0.213
T_ALPHA	0.001*** (0.001)	1.001 (0.10%)	0.001*** (0.002)	1.001 (0.07%)	0.001*** (0.001)	1.001 (0.1%)	0.001*** (0.000)	1.001 (0.1%)
T_RULES	-0.085*** (0.002)	0.918 (-8.2%)	-0.088*** (0.002)	0.916 (-8.4%)	-0.080*** (0.005)	0.923 (-7.7%)	-0.085*** (0.002)	0.918 (-8.2%)
Wald test χ^2 (p-value)	157.59** (0.000)		180.57** (0.000)		108.24** (0.000)		140.24** (0.000)	

Note ***, ** and * Indicate that Wald statistics are significant at 1%, 5% and 10%, respectively, using Wald test.

The proportional hazard assumption is violated in the four models listed in Table 5.19 based on the Schoenfeld residuals PH test. This test also shows that the time dependent variables are *TURNOVER*, *ACTIVITY*, *ALPHA*, and *RULES*. However, the interaction terms of both *TURNOVER* and *ACTIVITY* variables with time are not significant at 10% level in the four models employed. More specifically, p-values of $T_TURNOVER$ variable in Models 1, 2, 3, and 4 are 0.297, 0.346, and 0.280, and 0.325, respectively. In addition, 0.363, 0.312, 0.217, 0.236 are the p-values of $T_ACTIVITY$ variable in Models 1, 2, 3, and 4, respectively. Therefore, the time dependent variables based the raw survival time definition are *ALPHA* and *RULES* variables.

Wald test shows that all models existed in Table 5.19 have overall significance at 1% level (p-value equals 0.000 in each model); where Model 2 is the best model because it has the highest χ^2 value (180.57). The variables of *FIRMSZ*, *INSTITUTE*, *GROWTH*, *TURNOVER*, *OFFERSZ*, *INITIAL*, and *ALPHA* are significant in all models employed in Tables 5.16 and 5.19, with the same negative sign and the same significance levels, in most variables. In addition, *COVERAGE* variable has negative relationship with hazard rate in Models 1, 3, and 4 in Table 5.16, and in all models shown in Table 5.19. However, there are many differences among the results of the two tables. More specifically, *CURRENT* and *ACTIVITY* variables are significant in all models shown in Table 5.16, but not significant in any one of the models listed in Table 5.19. In addition, *ROE* variable is significant in Models 2, 3, and 4 in Table 5.16, but not significant at any model in Table 5.19.

Furthermore, *VC*, *RULES*, and *SCHEDULE* variables are only significant in the models that rely on raw survival time; as shown in Table 5.19. To detail, VC backing (*VC*) variable has significant positive relationship with the probability of delisting in Models 1, 2, and 3 with coefficients of 1.001, 1.054, and 0.838, respectively. This variable also has insignificant positive sign in all Cox regression models employed in Tables 5.16, 5.17, and 5.18. This positive sign is unexpected and means that the participation of VCs shortens the survival time of IPO firms. However, it could be explained by the arguments of Brav and Gompers (1997), and Jain et al. (2008).

Brav and Gompers (1997) claim that VCs may take their firms public before they are ready in order to invest in other new firms. In addition, Jain et al. (2008) argue that the positive role of VCs is provided by their existence in the IPO market for enough time after going public to provide their firms with the required monitoring and finance. Therefore, the short period of VC participation either before or after going public does not ensure the improvement of post-IPO performance of their firms. Further, this unexpected sign could be attributed to the irrelevance of using raw survival time definition.

Listing rules variable (*RULES*) has extremely positive sign in all models presented in Table 5.19 only. The values of hazard ratios are very large (1450, 1875, 1517, and 2109 in Models 1, 2, 3, and 4, respectively) with p-value equivalent to 0.000 in each model. This positive sign means that firms listed on or after the enforcement date of the new Egyptian listing rules on August 2002 have shorter time to involuntary delisting relative to those listed before that date. This relationship

weakens with the passage of time because the interaction term between rules variable and time (T_RULES) has a significant negative sign at 1% significance level.

The findings related to listing rules variable are expected and easy to interpret when defining the time variable as the listing period ($stime$); as shown in Table 5.19. This is because the new listing rules issued on August 2002 allowed the involuntary delisting of bad firms. Thus, bad firms that offered their IPOs before the enforcement date on August 2002 are expected to survive longer than their counterparts that offered their IPOs on or after that date. This is because these firms are exposed to delisting risk after certain periods from their IPO dates. The survival time is also expected to decline when the IPO firm offers its IPO shortly before August 2002. However, $RULES$ variable is not significant when using $astime$ as the time variable; as indicated in Table 5.16. This is because the definition of survival time in this case takes already the enforcement date into account, as detailed earlier in Chapter 4.

The listing schedule ($SCHEDULE$) variable is significant in all models shown in Table 5.19 with negative sign. This results support the argument that firms listed on the Official Schedule has, on average, longer survival time than those listed on the Unofficial Schedule (p-values in Models 1, 2, 3 and 4 are 0.013, 0.006, 0.001, and 0.002, respectively). These results are consistent with the Kaplan-Meier univariate survival analysis. To detail, the hazard ratios in Models 1, 2, 3 and 4 are 0.244, 0.174, 0.246 and 0.213, respectively. The value of 0.174 in Model 2 means that the IPO firms listed on the Official Schedule and survived to a given time have 17.4% of the involuntary delisting rate from the firms listed on the Unofficial Schedule.

To summarize, the overall significance of all Cox regression models illustrated in Tables 5.16 and 5.19 are accepted based on the Wald test. In addition, the variables of firm size, assets growth rate, cash coverage ratio, operating efficiency, offering size, initial return, insider and institutional ownership are quite robust to the way used to define survival time. However, VC backing, liquidity, profitability, IPO activity, listing rules, and listing schedule variables differ according to the way used to define survival time.

5.3.3.4 Comparing the Results of Cox Regression Models with Logit and Probit Models

Table 5.20 summarizes the results of testing hypotheses related to delisting risk determinants. Several notes are obtained by comparing Cox regression models with the logit and probit models. Specifically, all significant variables, except *LEVERAGE* variable, in the logit and probit models are also significant in Cox regression models with the same negative sign. These variables are *FIRMSZ*, *INSTITUTE*, *GROWTH*, *TURNOVER*, *OFFERSZ*, *INITIAL*, and *ALPHA*. In addition, the significance levels in Cox regression models are less than or equal to the significance levels in the logit and probit models.

Table 5.20 Summary of testing hypotheses results related to the determinants of delisting risk

Hypotheses	Variables (Expected sign)	Significant variables based on the multivariate analyses						Decision
		Logit 3 years	Probit 3 years	Logit 5 years	Probit 5 years	Cox (adjusted survival time)	Cox (raw survival time)	
H1	Firm Variables	√	√	√	√	√	√	Accepted
H1 ₁	Firm's age (-)							<i>Rejected</i>
H1 ₂	Firm size (-)	√	√	√	√	√	√	Accepted
H1 ₃	Firm type (-)							<i>Rejected</i>

Table 5.20 (continued) Summary of testing hypotheses results related to the determinants of delisting risk

Hypotheses	Variables (Expected sign)	Significant variables based on the multivariate analyses						Decision
		Logit 3 years	Probit 3 years	Logit 5 years	Probit 5 years	Cox (adjusted survival time)	Cox (raw survival time)	
	in privatization IPOs							
H1 ₄	Institutional ownership (+/-)	√ (-)	√ (-)	√ (-)	√ (-)	√ (-)	√ (-)	Accepted
H1 ₅	Venture-Capital backing (-)						√ (+)	Rejected
H1 ₆	Financial leverage (+)			√	√			Accepted
H1 ₇	Liquidity (-)					√		Accepted
H1 ₈	Asset growth rate (+/-)	√ (-)	√ (-)	√ (-)	√ (-)	√ (-)	√ (-)	Accepted
H1 ₉	Cash coverage ratio (-)					√	√	Accepted
H1 ₁₀	Operating performance (-)			√	√	√	√	Accepted
H1 _{10a}	Operating efficiency (-)			√	√	√	√	Accepted
H1 _{10b}	Profitability (-)					√		Accepted
H2	Offering Variables	√	√	√	√	√	√	Accepted
H2 ₁	Offering size (-)	√	√	√	√	√	√	Accepted
H2 ₂	IPO activity (+)					√ (-)		Rejected
H3	Signaling Variables	√	√	√	√	√	√	Accepted
H3 ₁	Quality of auditor (-)							Rejected
H3 ₂	Initial return (-)	√	√	√	√	√	√	Accepted
H3 ₃	Insider ownership (-)	√	√	√	√	√	√	Accepted
H4	Listing Variables	√				√	√	Accepted
H4 ₁	Listing rules (+) in firms listed on or after Aug. 2002						√	Accepted
H4 ₂	Listing schedules (-) in firms listed on the Official Schedule	√				√	√	Accepted

Financial leverage (*LEVERAGE*) variable has a positive association with the probability of involuntary delisting in all logit, probit, and Cox models employed, but it is only significant in some logit and probit models based on five years survival time. Furthermore, Cox regression analysis provides more significant variables compared with logit and probit models. Specifically, *CURRENT*, *COVERAGE*, *ROE*, *ACTIVITY*, *VC*, and *RULES* variables are only significant in some Cox regression models used. The variables of firm size, growth rate in assets, offering size, initial return, insider and institutional ownership are significant in all models irrespective of the statistical technique employed. Assets turnover variable is also significant in all models used in this study, except the logit and probit models based on three-year survival time.

The significant coefficients of the interaction term of current ratio, assets growth rate, cash coverage ratio, assets turnover, and insider ownership variables with time means that the negative relationship between these variables and the hazard rate decreases with the passage of time. Furthermore, the associations between firm's age, firm type, and quality of auditor variables in relation to delisting risk are not supported by any multivariate model from the models used in this study, in spite of their significance in the univariate analyses. Some of these variables are also not associated with delisting risk in other studies. For example, Wilbon (2002), Bhabra and Pettway (2003), Boubakri et al. (2005), and Ferris et al. (2007) report insignificant relationship between firm's age and the probability of involuntary delisting. Boubakri et al. (2005) also do not find significant relationship between firm's age and survival time. In addition, the quality of auditor is not associated significantly with survival time in the study of Lamberto and Rath (2010).

Schedule type variable is significant in Cox models that rely on Breslow method for ties, default standard error, and raw survival time. It is also significant in the three-year logit models used. In addition, VC backing and listing rules variables are only significant in Cox models based on raw survival time. Finally, the researcher prefers using Cox regression model over logit and probit models; due to its larger sample size. In addition, it considers the survival time and handles censored cases and time dependent variables.

5.4 SUMMARY

This chapter presents an analysis of delisting risk determinants in the Egyptian IPO equity market. Both univariate and multivariate analyses are employed to achieve this objective. Delisting risk is studied by both delisting rate and survival time. Thus, this chapter begins with the determinants of delisting rate followed by the determinants of survival time. Three univariate tests are used to identify the determinants of delisting rate, namely chi-square test for independence, independent samples t-test, and Mann-Whitney U test. Then, four logit and four probit models are employed as the multivariate techniques of delisting rate. The analysis of delisting rate relies on both three- and five-survival year definitions.

All the three univariate tests confirm the expected relationships between independent variables and delisting rate, except IPO activity variable. Additionally, all significant variables in the logit and probit models are also significant in the univariate analysis with the same sign. The overall significance based on the

likelihood ratio test is also accepted in all logit and probit models employed, and logit and probit models give qualitatively similar results.

The variables of firm size, institutional ownership, financial leverage, growth rate on assets, operating efficiency, offering size, initial return, and insider ownership have significant relationships with delisting rate in all or some logit and probit models employed. Although there are some similarities between the results of the three-year delisting rate analysis and those based five years, the overall significance is generally better in the models based on five-year survival time period. In addition, financial leverage and operating efficiency variables are only significant in the logit and probit models relying on five survival years, and listing schedule variable is only significant based on the three-year logit analysis.

Kaplan-Meier is the univariate analysis used to identify the determinants of survival time. All independent variables used, except IPO activity variable, have the expected significant association with survival time. As expected, the predictors which increase (decrease) survival time are the same predictors that decrease (increase) delisting rate. Cox regression models that rely on the Efron method for ties and the robust standard error method are used; as recommended by many authors (e.g., Garson, 2010; Guo, 2010). After rejecting the proportional hazards assumption in Cox regression, the appropriate model is Cox nonproportional hazards model. The results of the four Cox regression models used are as expected, consistent with each other in general, and in line with the results obtained from Kaplan-Meier univariate analysis.

Three robustness check procedures are used in Cox regression analysis. Firstly, the Breslow method for ties is used instead of the Efron method. Secondly, the default standard error method is used instead of the robust standard error. Thirdly, the raw survival time from the listing date to the delisting date is used instead of the survival time adjusted for enforcement date. Overall, there are similarities between the results after using these procedures and the original results. However, there are also some differences that support using the Efron method for ties and the robust standard error method based on the adjusted survival time. In addition, the researcher prefers relying on the results of Cox model due to its advantages over the logit and probit models.

All significant variables in the logit and probit models, except leverage variable, are also significant in Cox regression model. However, Cox regression model has more significant variables with better significance levels. Specifically, VC backing, liquidity, cash coverage ratio, profitability, IPO activity, and listing rules variables are only significant in some models based on Cox regression analysis. Moreover, firm size, institutional ownership, assets growth rate, operating efficiency, offering size, initial return, and insider ownership variables are quite robust to the model employed to check the determinants of delisting risk. This is because these variables are significant in all models employed in this study. The significant negative relationships of liquidity, assets growth rate, cash coverage ratio, operating efficiency, and insider ownership variables with the hazard rate decreases with the passage of time due to their significant relationships with time based on the adjusted survival time models.

Although the univariate analyses report significant relationships between firm's age, firm type, and auditor's quality variables in relation to delisting risk, the multivariate analyses do not confirm these relationships. In addition, schedule type variable is significant in logit models based only on the three-year survival time analysis and in Cox models that rely on Breslow method for ties, default standard error, and raw survival time. Furthermore, listing rules and VC backing variables are only significant in the models based on raw survival time definition. Therefore, all the four new variables used in this study (i.e., firm type, institutional ownership, listing rules, and listing schedule) are significant based on the results of the univariate analyses. However, only institutional ownership, listing rules, and listing schedule variables are significant in some or all multivariate analyses employed.

The following chapter summarizes the thesis, discusses research findings, shows implications and limitations of the study, and presents recommendations for future researches.

CHAPTER 6

DISCUSSION AND CONCLUSION

6.1 INTRODUCTION

This chapter summarizes the thesis, discusses its main findings and provides related recommendations. It is divided into six main sections. Section 6.2 presents an overall view of the study. Section 6.3, discusses the findings related to delisting rate and survival time analysis. Section 6.4 discusses the theoretical and empirical implications of the study, followed by Section 6.5 which shows the limitations of the study. Then, Section 6.6 presents suggestions for future research. Finally, this chapter ends with a summary in Section 6.7.

6.2 OVERALL VIEW OF THE STUDY

The main objective of this study is to identify the determinants of delisting risk in the Egyptian IPO equity market. Since delisting risk can be studied from two perspectives, namely delisting rate and survival time, this main objective is translated into the following three specific objectives; i) to identify the determinants of delisting rate, ii) to determine the explanatory variables of survival time, and iii) to test the influence of some new variables, namely firm type, institutional ownership, listing rules, and listing schedule on delisting risk.

This study is motivated by several issues. The adverse effect of involuntary delisting on shareholders' equity indicates that this is a crucial economic issue,

especially in the case of Egypt where the number of involuntary delisting cases taking place after the issuance of the new Egyptian listing rules on August 2002 is quite large; as detailed earlier in Chapter 1. There is thus a crucial need to understand the factors that contribute to involuntary delisting and to be able to forecast its occurrence in order to control and reduce the number of involuntary delisting firms. However, prior studies on delisting risk determinants of IPOs show mixed results in most cases. They also ignore some variables which are hypothesized to be influential in this study such as firm type, institutional ownership, and listing variables.

Moreover, previous studies on delisting risk have not utilized the Cox nonproportional hazards model despite its appropriateness in fitting the data for such study. The need to conduct this study is also justified by the lack of studies related to the determinants of IPO delisting risk in the Middle East and North Africa (MENA) region in general and in Egypt in particular. Given that most prior related studies are executed in the U.S context.

Delisting rate is the likelihood of involuntary delisting occurrence of a firm in a particular period of time, such as three or five years as adopted in this study and many other studies (e.g., Jain & Kini, 1999b; Demers & Joos, 2007; Yung et al., 2008). Survival time analysis on the other hand focuses on time span from listing date to involuntary delisting date; known as listing period (Boubakri et al., 2005; Li et al., 2006; Kooli & Meknassi, 2007). Two definitions are employed in the present study to define survival time. The first one is the listing period; referred to in this study as the "raw survival time". While, the second one; referred to as "adjusted survival time", considers the date when new listing rules are enforced, and therefore

defines survival time as the difference between the involuntary delisting date and either the listing or enforcement date, whichever comes later.

In guiding the framework and methodology of this study, three types of literature were reviewed, namely prior studies on the determinants of delisting rate, prior studies on the determinants of survival time, and prior studies on the determinants of both delisting rate and survival time. Eighteen variables are included as potential determinants for delisting rate and survival time. The study hypothesizes that delisting rate (survival time) is positively (negatively) related to financial leverage and IPO activity variables, and is negatively (positively) associated with firm's age, firm size, VC backing, liquidity, cash coverage, operating efficiency, profitability, offering size, auditor's quality, initial return, and insider ownership variables. In addition, privatized IPO firms, firms listed before August 2002 and those listed on the Official Schedule are expected to have less delisting rate and longer survival time. In addition, there are two points of view regarding the association of assets growth rate and institutional ownership variables with delisting risk.

In verifying the relationships and their significances of the above variables with delisting risk, this study employs the chi-square test for independence, t-test, and Mann-Whitney U test for the univariate analyses, and logit and probit models for the multivariate analyses related to delisting rate. The sample includes 178 IPO firms for the three survival years analyses and 169 IPO firms for the five survival years analyses. In addition, Kaplan-Meier univariate analysis and Cox nonproportional

hazards multivariate analysis are used to examine the determinants of IPO survival time based on 195 IPO firms.

6.3 THE MAIN FINDINGS OF THE STUDY

6.3.1 Findings Based on the Univariate Analyses

The results of univariate analyses show that delisting risk decreases significantly with the increase in firm's age, firm size, institutional ownership, liquidity, assets growth rate, cash coverage, operating efficiency, profitability, offering size, initial return, and insider ownership. It increases significantly, however, with the increase in financial leverage. In addition, privatized firms, firms backed by VCs, firms audited by reputable auditors, firms listed before August 2002, and those listed on the Official Schedule have significantly less delisting risk compared with other firms. These findings rely on both the delisting rate and survival time analyses.

6.3.2 Findings Based on the Multivariate Analyses

Overall, it can be concluded from the analysis that all significant variables based on the delisting rate analysis are also significant when survival time analysis is used, except leverage variable which is only significant in the five-year delisting rate analysis. However, survival time analysis exhibits more significant variables with better significance levels. Out of all the variables studied, a few however can be said to have a more definite influence on delisting risk since they are found to be significant in all models employed in this study. These variables are detailed as follows:

a) Firm size

Firm size variable has a significant negative relationship with delisting risk in all models employed. This result confirms the results of univariate analyses which support the argument that smaller firms have, on average, more delisting risk. That is explained by the lack of resources in smaller firms to recover from mistakes in investment strategy or to resist a decline in value in comparison to larger firms; as argued by the resource-based theory. It is also consistent with the results of several studies such as Peristiani (2003), Boubakri et al. (2005), Li et al. (2006), Charitou et al. (2007), Demers and Joos (2007), and Yung et al. (2008).

b) Institutional ownership

The findings related to institutional ownership variable supports that delisting risk decreases significantly with the high participation of institutional investors. This result is significant based on all models employed in this study. It also supports both the efficient monitoring hypothesis of Pound (1988) and the results of univariate analyses.

c) Growth rate in total assets

Asset growth variable has a significant negative relationship with delisting risk in all models employed in this study. This result is consistent with the results obtained from the univariate analyses, and could be attributed to the high firm size and profitability of firms with high growth rate. It is also consistent with the perspective of the resource-based theory.

d) Operating efficiency

Assets turnover ratio is the measure of operating efficiency used in this study. It associates negatively with the probability of involuntary delisting in all five-year delisting rate models. It also has the expected positive relationship with survival time in all models used. It means that survived firms operate their total assets more efficiently compared with other firms. This result supports the results obtained from the univariate analyses and confirms the argument that operating performance can be considered as an indicator of the firm's quality. It also supports the resource-based theory.

e) Offering size

Offering size has a significant negative relationship with delisting risk in all models used in this study. This negative relationship is consistent with the results of univariate analyses and supports the resource-based theory. It is also in line with the findings of Hensler et al. (1997), Jain and Kini (1999b), Bhabra and Pettway (2003), Jain and Martin Jr (2005), Kooli and Meknassi (2007), and Jain and Kini (2008) who argue that small issues are more speculative than large ones, and small issuers are more likely to suffer from financial difficulties. Thus, the larger the offering size, the better the survival profile of an IPO firm.

f) Initial return

Similar to the results obtained from the univariate analyses, there is a significant negative relationship between initial return variable and delisting risk in all models used in this study. This result is consistent with the signaling hypothesis

of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) which considers underpricing as a signal of the firm's quality. It is also consistent with the marketing event hypothesis of Chemmanur (1993) and Demers and Lewellen (2003) that regards it as a means for firm's publicity. In addition, this negative relationship is confirmed by Schultz (1993), Hensler et al. (1997), Peristiani (2003), Boubakri et al. (2005), Demers and Joos (2007), and Yung et al. (2008).

g) Insider ownership

All models used in this study confirm the expected negative relationship between insider ownership and delisting risk. This result is in line with the signaling hypothesis of Leland and Pyle (1977), and Grinblatt and Hwang (1989) who claim that insider ownership provides a positive signal of firm's quality. It also supports the agency cost hypothesis of Jensen and Meckling (1976) who argue that agency costs will reduce with the high percentage of insider ownership. It also confirms the findings of Hensler et al. (1997), Jain and Kini (2000, 2008), Peristiani and Hong (2004), and Goot et al. (2009), and the results of univariate analyses.

Finally, it is worth noting that institutional ownership, listing rules, and listing schedule variables, as new variables, are significant in all univariate analyses used and in some or all multivariate analyses employed. However, firm type variable is significant based only on the results of univariate analyses.

6.4 IMPLICATIONS OF THE STUDY

6.4.1 Implications to the Theory

One of the implications of the study is the introduction of four new variables, namely firm type, institutional ownership, listing schedule type and listing rules as potential predictors for IPO delisting risk and these variables are shown to be relevant. In addition, this study verifies the importance of a comprehensive set of predictors that are found to be significant determinants for IPO delisting risk in prior studies elsewhere. Moreover, agency cost, signaling, certification, marketing event, efficient monitoring, resource-based and trade-off theories are tested and supported in this study.

6.4.2 Implications to Research Methods

This study defines survival time by a definition derived from the Egyptian context. This definition takes into account the enforcement date of the new Egyptian listing rules issued on August 2002; as detailed earlier. In addition, the common survival time definition is used to check the robustness of results. Furthermore, the probit and Cox nonproportional hazards models are employed in this study. The probit model is used in very few delisting risk studies such as Willenborg and McKeown (2001), and Li et al. (2006). Moreover, it is the first time, as far as I know, to employ Cox nonproportional hazards model in the delisting risk literature.

6.4.3 Practical Implications

Several implications for investors, issuing firms, and listing rules setters are concluded from this study. The main message to prospective investors in the IPO firms is to invest in large firms with large offering sizes and in firms with low debts. In addition to investing in firms with high liquidity, assets growth rate, cash coverage, operating performance, initial return, insider and institutional ownership. It is also recommended to invest in firms issuing their IPOs in hot-issue periods.

The main message to the issuing firms is to defer the decision of going public until reaching a reasonable size, and to reduce debts in their financial structure. In addition, these firms should have high liquidity, cash coverage, assets growth rate, and operating performance before going public. If the issuing firm is a high quality one, it should underprice its issue, and hold the majority of shares through insiders. It also should time the offering in hot-issue periods to benefit from investors' overoptimism in these periods.

Listing rules setters can also benefit from the findings of this study to improve their listing rules. For example, they can impose minimum levels of liquidity, cash coverage, assets growth rate, insider ownership and operating efficiency for listing new shares. They also can impose maximum level of debts ratio on firms before listing their shares on the EGX. In addition, the high delisting risk of firms listed on the Unofficial Schedule requires raising listing rules related to this schedule. On October 2008, the Egyptian listing rules setters merged the Official and Unofficial Schedules of the Egyptian IPOs in one group called "Egyptian securities". This new listing procedure has similar requirements to those of the previous Official

Schedule. However, it is more severe than the requirements of listing on the previous Unofficial Schedule. This study supports this procedure to ensure the quality of listed firms.

6.5 LIMITATIONS OF THE STUDY

The findings of this study are constrained by some limitations. Firstly, the present study focuses only on the internal determinants of delisting risk and ignores the external determinants associated with political and economic environments. However, the researcher intended to do so to use only variables that can be controlled by the firm.

Secondly, the findings of this study are not applicable for non-financial firms since these firms have been purposely excluded because their accounting practices are subject to special regulations (Jaskiewicz et al., 2005). In addition, this exclusion is consistent with several authors in their studies to investigate firm performance (e.g., Jain & Kini, 1995, 1999; Bhabra & Pettway, 2003; Jain & Martin Jr, 2005; Jaskiewicz et al., 2005; Demers & Joos, 2007).

Thirdly, sample size is relatively small compared with other studies in that field. To detail, 195 IPO firms are used in the survival time analysis, and 178 (169) IPO firms are used to identify the determinants of delisting rate based on three (five) years survival time. However, this sample size exceeds 50% of the total population (67%, 61%, and 58% in survival time, three-year delisting rate, and five-year delisting rate analyses, respectively). In addition, the percentages of involuntary delisted firms in these samples (27%, 21%, and 30% in survival time, three-year

delisting rate, and five-year delisting rate analyses, respectively) are close to the percentage of delisted firms in the total population (26%).

6.6 SUGGESTIONS FOR FUTURE RESEARCH

This study provides several suggestions for future research not only for the IPO event but also for other corporate events such as seasoned equity offering (SEO), merger and acquisition (M&A), financial distress, and bankruptcy. More specifically, the present study could be extended by testing the impact of new variables on delisting risk such as the percentage of foreign ownership and the reputation of underwriter. Industry type also can be introduced in other studies with larger sample size and/or less number of variables. It is also important to examine the effect of VCs' monitoring quality variables on delisting risk of IPOs such as VC backing period both before and after going public, the number of VCs, and the VCs' participation and duration in the board of directors. The relationships between some of these variables and the post-issue operating performance of IPO firms are examined by Jain and Kini (1995), and Coakley, Hadass and Wood (2004).

In addition, more variables related to corporate governance could be employed as determinants for delisting risk such as the existence of non-executive chairman, and the size and independence of board of directors (Charitou et al., 2007; Lamberto & Rath, 2010). Moreover, the variables related to strategic investment decisions are not extensively studied as determinants for delisting risk such as investments in R&D and advertising, capital expenditures, the extent of diversification, and the degree of multi-nationality of IPO firms (Khurshed, Mudambi, & Goergen, 1999; Wilbon, 2002; Jain & Kini, 1999b, 2008). Additional

studies are needed to show the impact of suspension decision on stock prices and the survivability of IPO firms.

A study that compares the determinants of IPO delisting risk in sharia and non-sharia firms is also recommended. Other studies are needed to identify the determinants of voluntary delisting, M&A, and the survivability of SEO firms to compare these determinants with those of involuntary delisting. Cox regression model could be used in these studies and in other studies that aim to identify the determinants of financial distress and bankruptcy. However, the proportional hazards assumption should be tested first to choose the suitable Cox regression model.

The influence of the announcement for involuntary delisting on firms' stock prices and trading volume needs to be examined in the EGX. In addition, the effect of the new Egyptian listing rules issued on October 2008 on delisting risk of the Egyptian IPOs could be investigated in another research. Moreover, another research is needed to identify the reasons for listing the Egyptian closely traded firms in the EGX and the determinants of their delisting risk.

6.7 SUMMARY

An overview of the thesis is presented in the first part of this chapter. Then, the findings related to delisting rate and survival time analyses are discussed. It is found that firm size, growth rate in assets, operating efficiency, offering size, initial return, insider and institutional ownership variables have significant negative relationships with delisting risk in all multivariate analyses used in this study. In addition, three out of the four new variables used in this study, namely institutional

ownership, listing rules, and listing schedules are significant in all univariate analyses and in some or all multivariate analyses used. However, firm type variable is significant based only on the results of univariate analyses. Firm's age and auditor's quality variables are also insignificant based on the results of multivariate analyses used in this study.

The implications and limitations of the study are presented in the following two sections. Finally, some suggestions for future research are presented. Overall, this study confirms the importance of firm, signaling, offering, and listing variables as determinants for delisting risk. These determinants play significant role in discriminating delisted and survived firms. This conclusion relies on several model specifications and several robustness tests.

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APPENDICES

APPENDIX 1

**The Yearly Exchange Rate from the US Dollar (\$) to the Egyptian Pound (L.E)
over the Period of 1992- 2009**

Year	Exchange rate (from \$ to L.E)	Year (Quarter)	Exchange rate (from \$ to L.E)
1992	3.34	2001	4.58
1993	3.37	2002	4.63
1994	3.41	2003	6.17
1995	3.40	2004	6.07
1996	3.39	2005	5.74
1997	3.40	2006	5.71
1998	3.41	2007	5.52
1999	3.42	2008	5.51
2000	3.89	2009	5.55

Source: DataStream database

APPENDIX 2

A Summary of Selected Empirical Studies on the Determinants of Long-Run Stock Performance of IPOs

Author[s] (Year of study)	Country (Observation period) ¹	Sample size (Sample period)	The measure(s) of stock performance ² (Statistical technique(s))	Independent variable(s) (The relationship with stock performance)
Ritter (1991)	US (3 years)	1526 IPOs (1975-1984)	Unadjusted stock return (Multiple linear regression model)	- Ln firm's age (Significant positive relationship) - Offering size (Significant positive relationship) - The annual volume of IPOs in the year of issuance (Significant negative relationship) - Market adjusted initial return (Insignificant relationship) - Industry type (Significant relationship)
Menyah et al. (1995)	UK (1 year)	40 PIPOs ³ and 75 private IPOs (1981-1991)	Stock's buy-and-hold abnormal return (Univariate analysis)	Firm type (Significant overperformance of PIPOs and insignificant overperformance of private IPOs)
Brav and Gompers (1997)	US (5 years)	4341 IPOs (* 934 VC backed IPOs over the period of 1972-2002. * 3407 non- VC backed IPOs over the period of 1975-1992).	Log of stock's wealth relative (Multiple linear regression model)	- Firm size measured by the natural log of market capitalization (Significant positive relationship) - Venture-capital [VC] backing (Significant positive relationship) - Ln book to market value (Significant positive relationship) - lagged dividend price ratio for the market (Significant negative relationship)
Cai and Wei (1997)	Japan (3 and 5 years)	180 IPOs (1971-1992)	Stock's buy-and-hold abnormal return and wealth relative (Univariate analyses: t-test and	- Firm size (Significant negative relationship based only on 3 years observation period) - Offering size (Significant positive relationship)

¹ "Observation period" is the number of years from the IPO date over which the dependent variable is computed.

² The long-run stock performance is the dependent variable used in these studies.

³ "IPO" refers to initial public offering, and "PIPO" refers to privatization IPO.

Appendix 2 (Continued)

Author[s] (Year of study)	Country (Observation period) ¹	Sample size (Sample period)	The measure(s) of stock performance ² (Statistical technique(s))	Independent variable(s) (The relationship with stock performance)
Paudyal, Saadouni and Briston (1998)	Malaysia (1, 2, and 3 years)	95 IPOs in the main board [18 PIPOs and 77 private IPOs] (1984-1995)	binomial proportionality test	<ul style="list-style-type: none"> - Market to book ratio (<i>Insignificant relationship</i>) - IPO activity (<i>Insignificant relationship</i>) - Raw initial return (<i>Significant negative relationship</i>) - Ownership structure [i.e., institutional ownership, managerial ownership, and ownership concentration of the top 10 owners] (<i>Insignificant relationship</i>) - Industry type (<i>Insignificant relationship</i>) - IPO pricing regime (<i>Significant positive relationship after removing price limits</i>) - Firm type (<i>Insignificant relationship</i>) - Proportion of shares sold (<i>Significant negative relationship based only on 1 year</i>) - Market adjusted initial return (<i>Significant negative relationship</i>) - Underwriter reputation (<i>Significant positive relationship based only on 2 and 3 years</i>)
Jain and Kini (1999a)	US (3 and 5 years)	1037 IPOs (1976-1990)	Stock's buy-and-hold abnormal return (Multiple linear regression model)	<ul style="list-style-type: none"> - Ln firm's age (<i>Insignificant relationship</i>) - Ln offering size (<i>Significant negative relationship</i>) - Percentage of total issue offered by existing shareholders (<i>Significant positive relationship</i>) - Underwriter prestige (<i>Significant positive relationship</i>) - Underwriter warranty (<i>Insignificant relationship</i>) - Number of unaffiliated analysts (<i>Significant positive relationship</i>) - Standard deviation of aftermarket daily returns (<i>Significant negative relationship</i>)
How (2000)	Australia (1, 2, and 3 years)	130 IPOs (1979-1990)	Stock's buy-and-hold abnormal return (Multiple linear regression model)	<ul style="list-style-type: none"> - Offering size (<i>Insignificant relationship</i>) - Initial return (<i>Significant negative curvilinear relationship based only on 1 and 2 year stock returns</i>) - Insider ownership (<i>Insignificant relationship</i>) - Lag from offering date to listing date (<i>Significant positive relationship</i>)

Appendix 2 (Continued)

Author[s] (Year of study)	Country (Observation period) ¹	Sample size (Sample period)	The measure(s) of stock performance ² (Statistical technique(s))	Independent variable(s) (The relationship with stock performance)
Brounen and Eichholtz (2002)	Britain France Sweden (1 year)	54 IPO (1984-1999)	Stock's buy-and-hold abnormal return (Multiple linear regression model)	- Financial leverage (Insignificant relationship) - Offering size (Insignificant relationship) - Ln aftermarket standard deviation (Insignificant relationship) - Industry type (Retail IPOs are significantly more underperformed than other property types)
Corhay, Teo, and Rad (2002)	Malaysia (3 years)	258 IPOs (1992-1996)	Stock's cumulative abnormal return (Multiple linear regression model)	- Ln offering size (Significant negative relationship) - Book-to-market equity (Insignificant relationship) - Earnings to price ratio (Insignificant relationship) - Cash flows-to-price (Insignificant relationship) - Number of days between close of an IPO application and first day of trading (Insignificant relationship) - Reciprocal of the IPO subscription price (Insignificant relationship)
Durukan (2002)	Turkey (1, 2, and 3 years)	173 IPOs (1990-1997)	Stock's wealth relative (Multiple linear regression model based on enter and stepwise methods)	- Ln firm's age (Significant negative relationship based only on 2 years) - Ln firm size (Significant positive relationship based on 1 year and stepwise regression) - Firm type (Significant better performance in privatized firms) - Financial leverage measured by debts to equity ratio (Significant positive relationship based only on 1 year) - Ln offering size (Significant positive relationship based only on 1 year) - Initial returns (Insignificant relationship) - Proportion of shares sold (Significant negative relationship) - P/E ratio (Insignificant relationship) - Investor type (Insignificant relationship) - Method of IPO (Insignificant relationship)
Bhabra and Pettway (2003)	US (1 and 3 years)	242 IPOs (1987-1991)	Stock's buy-and-hold abnormal return (Multiple linear regression model)	* Firm Characteristics - Firm's age (Insignificant relationship) - Firm size (Significant negative relationship)

Appendix 2 (Continued)

Author[s] (Year of study)	Country (Observation period) ¹	Sample size (Sample period)	The measure(s) of stock performance ² (Statistical technique(s))	Independent variable(s) (The relationship with stock performance)
				<ul style="list-style-type: none"> - Financial leverage (<i>Insignificant relationship</i>) - Profitability (<i>Significant negative relationship based only on 1 year & Significant positive relationship based only on 3 years</i>) - Tangibility of assets (<i>Significant negative relationship based only on 1 year</i>) - Spending on R&D (<i>Significant positive relationship</i>) <p>* Offering Characteristics</p> <ul style="list-style-type: none"> - Offering size to total assets ratio (<i>Significant negative relationship based only on 1 year</i>) - Initial return (<i>Significant positive relationship based on 1 year & Significant negative relationship based on 3 years</i>) - Management sales of firm shares at the IPO (<i>Significant positive relationship</i>) - VC backing (<i>Significant positive relationship based only on 1 year</i>) - Underwriter prestige (<i>Significant positive relationship based only on 1 year</i>) - Number of risk factors (<i>Significant negative relationship based only on 1 year</i>)
Jelic and Briston (2003)	Poland (3 years)	165 IPOs [55 PIPOs and 110 private IPOs] (1991-1999)	Stock's buy-and-hold abnormal return and cumulative abnormal return (Univariate analyses: t-test and Mann-Whitney U test)	Firm type (<i>PIPOs outperform their private sector counterparts significantly only when international indices were used as benchmarks</i>).
Chan, Wang and Wei (2004)	China (1, 2, and 3 years)	570 A-Share IPOs (1993-1998)	Stock's cumulative abnormal return (Multiple linear regression model)	<ul style="list-style-type: none"> - Change in return on assets (<i>Significant positive relationship based only on 1 and 2 years</i>) - Change in operating cash flow on assets (<i>Significant positive relationship based only on 1 and 2 years</i>) - Growth rate of net sales (<i>Significant positive relationship</i>) - Change in asset turnover (<i>Insignificant relationship</i>)

Appendix 2 (Continued)

Author[s] (Year of study)	Country (Observation period) ¹	Sample size (Sample period)	The measure(s) of stock performance ² (Statistical technique(s))	Independent variable(s) (The relationship with stock performance)
Kooli and Suret (2004)	Canada (3 and 5 years)	445 IPOs (1991-1998)	Buy-and-hold abnormal return for small and large IPOs (Multiple linear regression model)	<ul style="list-style-type: none"> - Growth rate of capital expenditures (Significant negative relationship based only on 2 years) - Initial return (Significant negative relationship based only on 3 years and large IPO models) - IPO activity (Significant negative relationship based on all models used) - Industry type (Significant positive relationship in technology sector based only on 5 years and large IPO models)
Drobetz et al. (2005)	Switzerland (10 years)	120 IPOs (1983-2000)	Stock's buy-and-hold abnormal return, cumulative abnormal return and wealth relative (Skewness-adjusted t-test)	Firm size (Significant positive relationship: The long-run underperformance is attributed to the fact that IPO firms tend to be small firms).
Jaskiewicz et al. (2005)	Germany Spain (3 years)	153 IPOs from Germany and 43 IPOs from Spain (1990-2000)	Stock's buy-and-hold abnormal return (Multiple linear regression model)	<ul style="list-style-type: none"> - Firm's age (Significant negative relationship in family firms only) - Firm size (Significant positive relationship) - IPO activity (Insignificant relationship) - Family ownership (Significant positive relationship) - Country variable [i.e., Germany or Spain] (Insignificant relationship)
Omran (2005)	Egypt (1, 3, and 5 years)	53 PIPOs (1994-1998)	Stock's buy-and-hold abnormal return and cumulative abnormal return (Multiple linear regression model)	<ul style="list-style-type: none"> - Initial return (Significant negative relationship based only on 3 and 5 years) - Insider ownership (Insignificant relationship) - Ex-ante uncertainty measured by the standard deviation for 1 year after privatization (Significant positive relationship based only on 1 year) - Times-offer subscribed (Significant negative relationship based only on 3 years) - Timing of sales [i.e., order in privatization program] (Insignificant relationship) - Market volatility (Insignificant relationship) - P/E ratio (Significant negative relationship)

Appendix 2 (Continued)

Author[s] (Year of study)	Country (Observation period)¹	Sample size (Sample period)	The measure(s) of stock performance² (Statistical technique(s))	Independent variable(s) (The relationship with stock performance)
Ahmad-Zaluki et al. (2007)	Malaysia (3 years)	454 IPOs (1990-2000)	Stock's buy-and-hold abnormal return and wealth relative (Univariate analyses: skewness- adjusted t-test, ANOVA test, and binomial proportionality test)	<ul style="list-style-type: none"> - Firm size (<i>Insignificant relationship</i>) - Firm type (<i>Insignificant relationship</i>) - Offering size (<i>Significant negative relationship</i>) - IPO activity (<i>Significant positive relationship</i>) - Initial return (<i>Significant positive relationship</i>) - Board of listing (<i>Insignificant relationship</i>) - Industry type (<i>Insignificant relationship</i>) Firm type (<i>Marginally significant better performance in privatized firms based on ANOVA for 2 years</i>)
Peter (2007)	Sri Lanka (1, 2, and 3 years)	30 IPOs (1996-2000)	Stock's buy-and-hold abnormal return (Univariate analyses: ANOVA and Mann-Whitney U test)	<ul style="list-style-type: none"> - Dummies for year of issue (<i>Significant relationships</i>) - Average earnings growth rate after listing (<i>Significant positive relationship</i>) - EBIT growth rate (<i>Insignificant relationship</i>) - Offering size (<i>Significant negative relationship</i>) - Market adjusted initial return (<i>Significant negative relationship</i>) - The proportion of shares retained by the government at issue (<i>Significant positive relationship</i>) - The probability of being successful in the allocation (<i>Significant positive relationship</i>) - Earnings per share before listing (<i>Significant negative relationship</i>) - Long-term investment to total assets at listing (<i>Insignificant relationship</i>) - Whether the referee and underwriter firm different investment banks (<i>Significant negative relationship</i>) - Whether the firm issue B-Shares (<i>Significant positive relationship</i>)
Cai et al. (2008)	China (3 years)	335 IPOs (1997-2001)	Stock's buy-and-hold abnormal return and cumulative abnormal return before and after excluding outliers. (Multiple linear regression model)	<ul style="list-style-type: none"> - Firm size measured by log of market capitalization (<i>Insignificant relationship</i>) - Growth rate in the level of turnover (<i>Insignificant</i>)
Coakley, Hadass and Wood (2008)	UK (3 years)	591 IPOs (1985-2003)	Stock's cumulative abnormal return (Multiple linear regression model)	

Appendix 2 (Continued)

Author[s] (Year of study)	Country (Observation period) ¹	Sample size (Sample period)	The measure(s) of stock performance ² (Statistical technique(s))	Independent variable(s) (<i>The relationship with stock performance</i>)
Hsu and Chang (2008)	US (9 years)	3845 IPOs [1061 VC, 2784 non-VC] (1982-1994)	Stock's buy-and-hold abnormal return and cumulative abnormal return (Descriptive statistics)	<i>relationship</i> - Growth rate in the level of earnings (EBIT) (<i>Significant positive relationship</i>) - IPO activity (<i>Significant positive relationship</i>) - VC backing (<i>Insignificant relationship</i>) - Industry type (<i>Insignificant relationship</i>) - Underwriter reputation (<i>Insignificant relationship</i>) VC backing (<i>VC-backing firms outperform non-VC backing ones</i>).
Westerman, Geiger and Cyr (2008)	US (3 years)	402 IPOs [160 VC, 242 non-VC] (1993)	The absolute stock price at year-end 1996 and log of stock price growth from the time of the IPO through year-end 1996 (Hierarchical regression analysis)	- Firm's age (<i>Insignificant relationship</i>) - Net income per share (<i>Insignificant relationship</i>) - Offering size (<i>Significant positive relationship based on absolute stock price</i>) - Offer price (<i>Significant negative relationship based on absolute stock price</i>) - VC backing [VC] (<i>Insignificant relationship</i>) - Incentive stock option [ISO] (<i>Insignificant relationship</i>) - Stock purchase plans (<i>Insignificant relationship</i>) - VC * ISO (<i>Significant positive relationship</i>) - VC * Stock purchase (<i>Insignificant relationship</i>) - Number of risk factors (<i>Insignificant relationship</i>) VC backing (<i>VC backed IPOs are not significantly better than non VC-backed IPOs in Hong Kong Market</i>).
Wong and Wong (2008)	China (1 year)	358 IPOs [67 VC, 291 non-VC] (1999-2003)	Stock's buy-and-hold abnormal return (t-test)	
Sentis (2009)	France (1 year)	120 IPOs during the high-tech bubble (1998-2000)	Stock's buy-and-hold abnormal return (Multiple linear regression model)	- Firm's age (<i>Insignificant relationship</i>) - Financial leverage measured by debts to fixed assets (<i>Insignificant relationship</i>) - Q Tobin [market value of equity divided by its book value at the offering date] (<i>Significant negative relationship</i>)

Appendix 2 (Continued)

Author[s] (Year of study)	Country (Observation period) ¹	Sample size (Sample period)	The measure(s) of stock performance ² (Statistical technique(s))	Independent variable(s) (The relationship with stock performance)
Yip et al. (2009)	US (1 year)	1772 IPOs (1996-2000)	Market adjusted returns and cumulative abnormal return every month from 1 to 12 months (Multiple linear regression model)	<ul style="list-style-type: none"> - Offering size measured by the natural log of gross proceeds (<i>Insignificant relationship</i>) - Proportion of shares sold (<i>Significant positive relationship</i>) - management sales dummy * Proportion of shares sold (<i>Insignificant relationship</i>) - High tech industry dummy (<i>Insignificant relationship</i>) - Observed proportion of IPO cash flow used for investing in fixed assets, spending in R&D or deleveraging during the two first years after the IPO (<i>Significant positive relationship</i>)
Chen et al. (2010)	Taiwan (5 years)	261 IPOs issued in over- the-counter [OTC] (1991-2002)	Stock return minus market return in calendar month "t" over the five-year period after IPO issuance) (Multiple linear regression based on five-factor model)	<ul style="list-style-type: none"> - Underwriter reputation [UW] (<i>Significant negative relationship</i>) - VC backing [VC] (<i>Significant positive relationship</i>) - High-tech industry [HC] (<i>Insignificant relationship</i>) - UW * VC (<i>Significant negative relationship</i>) - UW * HC (<i>Insignificant relationship</i>) - UW * VC * HC (<i>Insignificant relationship</i>)
				<ul style="list-style-type: none"> - Market factor [Market return minus risk free return] (<i>Significant positive relationship</i>) - Size factor [The average monthly return of small stocks minus that of big stocks]. (<i>Significant positive relationship</i>) - Book to market factor [the average monthly return of "high" book-to-market stock minus that of "low" book-to-market stocks] (<i>Significant negative relationship</i>) - The leverage factor [the average monthly return of "high" leveraged firms minus that of "low" leveraged firms] (<i>Significant positive relationship</i>) - The liquidity factor [the average monthly return of "low" liquidity stocks minus that of "high" liquidity stocks] (<i>Significant negative relationship</i>)

APPENDIX 3

A Summary of Selected Empirical Studies on the Determinants of Long-Run Operating Performance of IPOs

Author[s] (Year of study)	Country (Performance window)	Sample size ¹ (Sample period)	Operating performance measure(s) ² (Statistical technique(s))	Independent Variables(s) (The relationship with operating performance)
Jain and Kini (1994)	US (-1 year to +5 years)	682 IPOs (1976-1988)	The industry adjusted relative performance, based either on the operating ROA or operating cash flows to total assets, of the first three (five) years average after the IPO to the performance of the pre-IPO year (Wilcoxon two-sample signed rank test and multiple linear regression model)	- Initial return (<i>Insignificant relationship</i>) - Managerial ownership (<i>Significant positive relationship</i>)
Jain and Kini (1995)	US (-1 to +3)	272 IPOs [136 VC backed and 136 non-VC backed matched by industry and size] (1976-1988)	The relative performance, based either on the operating ROA or operating cash flows to total assets, of: - One, two, and three post-IPO years to the performance of the pre-IPO year (Wilcoxon two-sample signed rank test) - The first year and the average of the three years after the IPO to the performance of the pre-IPO year (Multiple linear regression model)	- Log offering size (<i>Significant positive relationship</i>) - Insider ownership retention (<i>Significant positive relationship</i>) - VC backing (<i>Significant positive relationship in VC backed firms</i>) - Number of VCs (<i>Significant positive relationship</i>) - Board participation by VCs (<i>Significant positive relationship based only on operating return on assets from year -1 to +1</i>) - Duration of VC participation on board of directors (<i>Insignificant relationship</i>) - The change in discretionary expenditures [i.e., sum of capital expenditure, advertising and R&D expenses] (<i>Significant negative relationship</i>)
Cai and Wei (1997)	Japan (-5 to +5)	180 IPOs (1971-1992)	Change in ordinary income to total assets ratio adjusted by industry medians and matching firms. (Multiple linear regression model)	- Total asset growth from year -1 to +1 (<i>Significant negative relationship</i>) - Percentage of shares offered (<i>Insignificant relationship</i>) - Post-issue holdings by directors one-year after offering

¹ "IPO" is the initial public offering, and "PIPO" is the privatization IPO.

² The long-run operating performance is the dependent variable used in these studies, and it is calculated based on the performance window. "EPS" is the earnings per share. "ROS" is the return on sales, "ROA" is the return on assets, "ROE" is the return on equity, and "EBIT" is the earnings before interest and taxes.

Appendix 3 (Continued)

Author[s] (Year of study)	Country (Performance window)	Sample size ¹ (Sample period)	Operating performance measure(s) ² (Statistical technique(s))	Independent Variable(s) (The relationship with operating performance)
Mikkelsen, Partch and Shah (1997)	US (-1 to +10)	283 IPOs (1980-1983)	Industry adjusted operating income to total assets ratio (Multiple linear regression model)	<p><i>(Insignificant relationship)</i></p> <ul style="list-style-type: none"> - Change in directors' holdings from year -1 to +1 <i>(Insignificant relationship)</i> - Firm's age <i>(Significant positive relationship)</i> - Firm size <i>(Significant positive relationship)</i> - Ownership structure variables <i>(Insignificant relationship)</i> - Fraction of outside board directors at the offering time <i>(Significant positive relationship based only on year 1)</i> - Fraction of shares sold by existing shareholders in the offering <i>(Significant positive relationship)</i>
Jain and Kini (1999a)	US (-1 to +5)	1037 IPOs (1976-1990)	<ul style="list-style-type: none"> - The relative performance, based on "Operating ROA, operating cash flows to total assets, and ROA", of zero, one, two, and three post-IPO years to the performance of the pre-IPO year (Wilcoxon two-sample signed rank test) - The unadjusted average operating performance, based on operating ROA and operating cash flows to total assets, of the first three (five) years after the IPO (Multiple linear regression model) 	<ul style="list-style-type: none"> - Operating return on assets one-year before the IPO <i>(Significant positive relationship)</i> - Ln offering size <i>(Significant positive relationship)</i> - Underwriter prestige <i>(Significant positive relationship)</i> - Underwriter warranty <i>(Insignificant relationship)</i> - Number of unaffiliated analysts <i>(Significant positive relationship)</i>

Appendix 3 (Continued)

Author[s] (Year of study)	Country (Performance window)	Sample size (Sample period)	Operating performance measure(s) (Statistical technique(s))	Independent Variable(s) (The relationship with operating performance)
Kutsuna, Okamura and Cowling (2002)	Japan (-5 to +3)	247 IPOs (1995-1996)	Industry median adjusted values of ordinary profits to net sales ratio (Multiple linear regression model)	<ul style="list-style-type: none"> - Ln firm's age (<i>Insignificant relationship</i>) - Firm size measured by: <ul style="list-style-type: none"> * The natural log of market capitalization at the offering date (<i>Significant positive relationship</i>) * The log of employees' number (<i>Significant negative relationship</i>) - Ownership structure variables before the IPO (<i>Insignificant relationship</i>) - Ownership stake after IPO by the top shareholder (<i>Significant positive relationship</i>) - The change in shareholdings before and after IPO of the top shareholder (<i>Significant positive relationship</i>) - Ownership stake after IPO by top 10 shareholders (<i>Insignificant relationship</i>) - The change in shareholdings before and after IPO of the top 10 shareholders (<i>Insignificant relationship</i>) - VC backing one-year after IPO (<i>Significant positive relationship</i>) - Bank participation one year after IPO (<i>Insignificant relationship</i>) - Manufacturing industry (<i>Insignificant relationship</i>) * The ownership structure determinants of the values of ROS, ROA, and ROE: <ul style="list-style-type: none"> - Firm type (<i>Insignificant relationship</i>) - The percentage of shares held by the government (<i>Significant positive relationship based only on ROS</i>) - Managerial ownership (<i>Significant positive relationship based only on ROA</i>) - Institutional ownership for investors who hold more than 2% (<i>Significant positive relationship based only on ROA</i>) - Individual blockholders' ownership (more than 2%) (<i>Significant negative relationship based only on ROA and ROE</i>) - GDP growth (<i>Significant positive relationship based only on ROA</i>)
Sun and Tong (2002)	Malaysia (-3 to +3)	24 PIPOs (1983-1997)	The unadjusted values and changes measures of (ROS, ROA, and ROE) (Pooled regression model for independent variables related to ownership structure, and multiple linear regression model for independent variables related to incentive schemes and management changes)	

Appendix 3 (Continued)

Author[s] (Year of study)	Country (Performance window)	Sample size ¹ (Sample period)	Operating performance measure(s) ² (Statistical technique(s))	Independent Variable(s) (The relationship with operating performance and ROE)
Wei, Varela, D'Souza and Hassan (2003)	China (-3 to +3)	208 PIPOs (1990-1997)	Unadjusted change in ROS (Multiple linear regression model)	<p>* <u>The incentive schemes and management changes determinants of the changes in ROS, ROA, and ROE:</u></p> <ul style="list-style-type: none"> - Change in GDP growth (<i>Insignificant relationship</i>) - Change in director remuneration (<i>Significant negative relationship based only on ROE</i>) - Stock options to directors (<i>Significant positive relationship based only on ROE</i>) - Change in key management people [i.e., CEO and/or managing directors] (<i>Significant negative relationship based only on ROS and ROA</i>)
Balatbat et al. (2004)	Australia (+1 to +5)	313 IPOs (1976-1993)	- ROA before interest and taxes in IPO firm minus the return in the control firm matched by industry and size (OLS and 2SLS multiple linear regression models)	<ul style="list-style-type: none"> - Ln offering size (<i>Significant negative relationship</i>) - Percentage of state ownership after privatization (<i>Insignificant relationship</i>) - Offering date (<i>Significant negative relationship in recently privatizations</i>) - Location (<i>Insignificant relationship</i>) - Percentage of foreign ownership in privatized firms (<i>Significant negative relationship</i>) - Firm's age (<i>Significant positive relationship</i>) - Financial leverage measured by debts ratio (<i>Significant negative relationship</i>) - Insider ownership (<i>Significant positive relationship</i>) - Institutional ownership (<i>Significant positive relationship</i>) - Proportion of outside directors (<i>Insignificant relationship</i>) - The separation of CEO and chairperson (<i>Significant positive relationship</i>) - The existence of blockholders (<i>Insignificant relationship</i>) - Proportion of tangible assets to total assets (<i>Significant positive relationship</i>)

Appendix 3 (Continued)

Author[s] (Year of study)	Country (Performance window)	Sample size ¹ (Sample period)	Operating performance measure(s) ² (Statistical technique(s))	Independent Variable(s) (The relationship with operating performance)
Coakley et al. (2004)	UK (-1 to +5)	568 IPOs [304 VC backed and 264 non-VC backed] (1985-2000)	Unadjusted operating cash flow over assets five years post-IPO relative to pre-IPO year (Multiple linear regression model)	<ul style="list-style-type: none"> - Ln firm's age (<i>Significant positive relationship</i>) - Firm size measured by log of market capitalization (<i>Insignificant relationship</i>) - Turnover to assets ratio (<i>Insignificant relationship</i>) - EBIT to assets ratio (<i>Insignificant relationship</i>) - IPO activity (<i>Significant negative relationship</i>) - Initial return (<i>Significant negative relationship</i>) - VC backing (<i>Significant positive relationship</i>) - VC reputation (<i>Significant negative relationship</i>) - Number of VCs holding equity stakes at the IPO time (<i>Insignificant relationship</i>) - The aggregate VC equity stake before the IPO (<i>Significant positive relationship</i>) - VC participation in board of directors at the IPO time (<i>Insignificant relationship</i>) - Ln average funds managed by the VCs before the IPO (<i>Significant positive relationship</i>) - Underwriter reputation (<i>Significant positive relationship</i>) - high-tech industry (<i>Significant negative relationship</i>)
Kim, Kitsabunnarat and Nofsinger (2004)	Thailand (-1 to +1)	133 IPOs (1987-1993)	The change in industry median-adjusted EBIT to total assets (Multiple linear regression model)	<ul style="list-style-type: none"> - Firm's age (<i>Significant positive relationship</i>) - Ln firm size (<i>Insignificant relationship</i>) - Sales growth rate (<i>Significant positive relationship</i>) - Managerial ownership (<i>Significant positive relationship in firms with 'low' and 'high' levels of managerial ownership, and significant negative relationship in firms with "intermediate" levels</i>) - Capital expenditure (<i>Insignificant relationship</i>) - Bank loans to total assets (<i>Significant negative relationship</i>)

Appendix 3 (Continued)

Author[s] (Year of study)	Country (Performance window)	Sample size ¹ (Sample period)	Operating performance measure(s) ² (Statistical technique(s))	Independent Variable(s) (The relationship with operating performance)
Alvarez and Gonzalez (2005)	Spain (-1 to +3)	111 IPOs (1985-1997)	Operating performance (ROA, ROE, and operating cash flow to total assets) in year +3 with respect to the year prior to going public (year -1) adjusted for the variation in industry (Multiple linear regression model)	- Ln firm's age (<i>Insignificant relationship</i>) - Firm size measured by the log of total assets (<i>Significant positive relationship</i>) - Firm type (<i>Significant worse performance in privatized firms</i>) - Insider ownership (<i>Significant positive relationship</i>) - Concentration of ownership (<i>Insignificant relationship</i>)
Huang and Song (2005)	China (-3 to +3)	44 PIPOs, and 44 private IPOs matched by size, industry, business and time of listing used as control firms (1993-2000)	ROS, ROA, ROE, and assets turnover (Kruskal- Wallis test)	Firm type (<i>Significant positive relationship in PIPOs based on ROE</i>)
Jain and Kini (2008)	US (-1 to +5)	3837 IPOs (1980-1997)	Industry adjusted operating income to book value of assets, operating income to sales, operating income plus R&D expense to book value of assets, and operating income plus R&D expense to book value of sales based on the level, change, and regression-based models (Multiple linear regression model)	- Ln offering size (<i>Significant positive relationship</i>) - VC backing (<i>Significant positive relationship</i>) - Managerial ownership retention (<i>Significant positive relationship in regression-based models based on assets</i>) - Extent of diversification (<i>Significant positive relationship in models based on assets</i>) - Advertising intensity (<i>Insignificant relationship</i>) - Capital expenditure intensity (<i>Significant positive relationship based on change models</i>) - R&D intensity (<i>Significant positive relationship in change models and significant negative relationship in some regression-based models</i>) - Underwriter prestige (<i>Significant positive relationship in regression-based models</i>)

Appendix 3 (Continued)

Author[s] (Year of study)	Country (Performance window)	Sample size ¹ (Sample period)	Operating performance measure(s) ² (Statistical technique(s))	Independent Variable(s) (The relationship with operating performance)
Jain et al. (2008)	US (The number of quarters elapsed between the IPO quarter and the quarter in which firm's operating profit is first positive after the IPO)	160 internet IPOs (1996-2000)	The probability of post IPO profitability; where profitability is measured by the quarterly operating income before depreciation (Cox proportional hazards model)	<ul style="list-style-type: none"> - Risk of issue (Significant positive relationship in change models and significant negative relationship in some regression-based models) - Firm's age (Significant positive relationship) - Pre-IPO number of employees (Significant positive relationship) - Ln offering size (Significant negative relationship) - VC backing (Significant negative relationship) - Proportion of outside directors (Significant negative relationship) - Percentage of change in ownership of the top three officers and directors around the IPO (Significant negative relationship) - Age of the CEO (Insignificant relationship) - Whether CEO's past experience is with a reputable firm (Insignificant relationship) - Whether CEO has relevant industry experience (Significant negative relationship) - Whether CFO's past experience is with a reputable firm (Significant negative relationship) - Whether CFO has relevant industry experience (Insignificant relationship) - Valuation uncertainty (Significant negative relationship) - Pre-IPO demand (Significant positive relationship) - Underwriter prestige (Insignificant relationship) - Number of risk factors (Significant negative relationship)
Wong and Wong (2008)	China (+1 to +2)	358 IPOs [67 VC, 291 non-VC] (1999-2003)	Operating performance measured by EPS, ROE, ROA, and operating profit margin for one and two years after the IPO (T-test)	<ul style="list-style-type: none"> - VC backing (Insignificant relationship)

APPENDIX 4

A Summary of Selected Empirical Studies on the Determinants of Financial Distress and Bankruptcy Risks

Author[s] (Year of study)	Sample size Country (Period examined)	Focus (Statistical technique(s))	Independent variables (The relationship with risk)
Beaver (1966)	79 failed and 79 non- failed firms US (1954-1964)	Bankruptcy risk (Univariate analysis: Dichotomous classification test)	- Financial leverage measured by total debts to total assets (<i>Significant positive relationship</i>) - Coverage measured by cash flow to total debts (<i>Significant negative relationship</i>) - Profitability measured by return on assets (<i>Significant negative relationship</i>)
Altman (1968)	33 bankrupt firms and 33 non-bankrupt firms US (1946-1964)	Bankruptcy risk (Multiple discriminant analysis [MDA])	- Financial leverage measured by market value of equity to book value of total debt (<i>Significant negative relationship</i>) - Liquidity measured by working capital to total assets (<i>Significant negative relationship</i>) - Operating efficiency measured by assets turnover ratio (<i>Significant negative relationship</i>) - Profitability measured by return on assets (<i>Significant negative relationship</i>) - Retained earnings to total assets (<i>Significant negative relationship</i>)
Ohlson (1980)	105 bankrupt firms and 2058 non- bankrupt firms US (1970-1976)	Bankruptcy risk (Binary logit analysis)	- Firm size (<i>Significant negative relationship</i>) - Financial leverage measured by total liabilities to total assets (<i>Significant positive relationship</i>) - Liquidity measured by working capital to total assets (<i>Significant negative relationship</i>) - Profitability measured by return on assets and funds provided by operations divided by total liabilities (<i>Significant negative relationship</i>)
Zmijewski (1984)	81 bankrupt firms and 1600 non- bankrupt firms US (1972-1978)	Bankruptcy risk (Binary probit analysis)	- Financial leverage measured by total debt to total assets (<i>Significant positive relationship</i>) - Liquidity measured by current ratio (<i>Insignificant relationship</i>) - Profitability measured by return on assets (<i>Significant negative relationship</i>)
Seguin and Smoller (1997)	5896 firms US	Financial distress risk five-years after listing	- Firm size measured by the natural log of market capitalization (<i>Significant negative relationship</i>)

Appendix 4 (Continued)

Author[s] (Year of study)	Sample size Country (Period examined)	Focus (Statistical technique(s))	Independent variables (The relationship with risk)
Ward and Foster (1997)	The original (hold-out) sample includes 253 (106) healthy firms, 29 (28) bankrupt firms, and 35 (23) firms experienced a loan default or debt for accommodation US (1988-1989 for the original sample and 1990 for the hold-out sample)	Financial distress and bankruptcy risks one, two, and three years before the event (Binary logit analysis)	<ul style="list-style-type: none"> - Ln stock price (Significant negative relationship) - Ln number of shares (Significant negative relationship) - Firm size measured by the natural log of total assets (Significant negative relationship in bankruptcy based on 3 years, and distress based on 1, 2, and 3 years) - Financial leverage measured by owner's equity to total liabilities (Significant negative relationship in bankruptcy based on 1, 2, and 3 years, and in distress based on 1 and 2 years) - Liquidity measured by: <ul style="list-style-type: none"> * Current ratio (Significant negative relationship in bankruptcy based on 2 years, and significant positive relationship in distress based on 3 years) * Current assets to total assets (Significant negative relationship in distress based on 1, 2, and 3 years) * Cash plus marketable securities to total assets (Significant negative relationship in distress based on 2 and 3 years) - Operating efficiency measured by current assets turnover (Significant negative relationship in distress based on 1 and 3 years) - Profitability measured by return on assets (Significant negative relationship in bankruptcy based on 1 year, and in distress based on 1, 2, and 3 years) - Cash flow variables: <ul style="list-style-type: none"> * Cash flow from operating activities to total liabilities (Significant negative relationship in bankruptcy based on 2 years, and in distress based on 1 and 3 years) * Cash flow from investing activities to total liabilities (Significant positive relationship in distress based on 1 year) * Cash flow from financing activities to total liabilities (Insignificant relationship)
Lennox (1999)	949 firms in the original sample "90 failed and 859 non-failed", and 3288 in the hold-out sample	Bankruptcy risk (Binary logit, binary probit, and multiple discriminant analyses)	<ul style="list-style-type: none"> - Firm size measured by number of employees (Significant negative relationship) - Financial leverage (Significant positive relationship) - Business cycle (Significant less risk if the economy is currently in a recession period)

Appendix 4 (Continued)

Author[s] (Year of study)	Sample size Country (Period examined)	Focus (Statistical technique(s))	Independent variables (The relationship with risk)
Nam and Jann (2000)	"33 failed and 3255 non-failed" UK (1987-1994)	Bankruptcy risk (Binary logit analysis)	<ul style="list-style-type: none"> - Return on capital (<i>Significant negative relationship</i>) - Cash flow variables: * Debtor turnover ratio (<i>Significant negative relationship</i>) * Cash ratio (<i>Significant negative relationship</i>) * Gross cash flow ratio (<i>Significant negative relationship</i>) - Industry type (<i>significant relationship</i>) - Financial expenses to sales (<i>Significant positive relationship</i>) - Debt coverage (<i>Significant negative relationship</i>) - Receivables turnover ratio (<i>Significant positive relationship</i>)
Shumway (2001)	2894 firms (including 300 bankrupt firms) US (1962-1992)	Bankruptcy risk (Discrete-time hazard model)	<ul style="list-style-type: none"> - Ln firm's age (<i>Insignificant relationship</i>) * Results related to Altman's (1968) model: - Market value of equity to book value of total debt (<i>Significant negative relationship</i>) - Working capital to total assets (<i>Insignificant relationship</i>) - Assets turnover ratio (<i>Insignificant relationship</i>) - Return on assets (<i>Significant negative relationship</i>) - Retained earnings to total assets (<i>Insignificant relationship</i>) * Results related to Zmijewski's (1984) model: - Total debts to total assets (<i>Significant positive relationship</i>) - Current ratio (<i>Insignificant relationship</i>) - Return on assets (<i>Significant negative relationship</i>) * Results related to market-driven variables: - Firm's relative market size (<i>Significant negative relationship</i>) - Firm's past excess stock returns (<i>Significant negative relationship</i>) - Idiosyncratic standard deviation of stock returns (<i>Significant positive</i>)

Appendix 4 (Continued)

Author[s] (Year of study)	Sample size Country (Period examined)	Focus (Statistical technique(s))	Independent variables (<i>The relationship with risk</i> <i>relationship</i>)
Chava and Jarrow (2004)	17460 firms (including 1197 bankrupt firms) US (1962-1999)	Bankruptcy risk (Discrete-time hazard model)	<ul style="list-style-type: none"> - Ln firm's age (<i>Insignificant relationship</i>) - Industry type (<i>Significant relationship</i>) * Results related to Altman's (1968) model: - Market value of equity to book value of total debt (<i>Significant negative relationship</i>) - Working capital to total assets (<i>Significant negative relationship</i>) - Assets turnover ratio (<i>Significant negative relationship</i>) - Return on assets (<i>Significant negative relationship</i>) - Retained earnings to total assets (<i>Insignificant relationship</i>) * Results related to Zmijewski's (1984) model: - Total debts to total assets (<i>Significant positive relationship</i>) - Current ratio (<i>Significant negative relationship</i>) - Return on assets (<i>Significant negative relationship</i>) * Results related to market-driven variables [from Shumway's (2001) study]: - Firm's relative market size (<i>Significant negative relationship</i>) - Firm's past excess stock returns (<i>Significant negative relationship</i>) - Idiosyncratic standard deviation of stock returns (<i>Significant positive relationship</i>)
Beaver, McNichols and Jung-Wu (2005)	544 bankrupt firms and 4237 non- bankrupt firms US (1962-2002)	Bankruptcy risk (Discrete-time hazard model)	<ul style="list-style-type: none"> * Accounting-based variables: - Financial leverage measured by total liabilities to total assets ratio (<i>Significant positive relationship</i>) - Profitability measured by return on assets (<i>Significant negative relationship</i>) - Cash-flow to total liabilities ratio (<i>Significant negative relationship</i>) * Market-based variables: - Firm size measured by the natural log of market capitalization (<i>Significant negative relationship</i>) - Lagged cumulative security residual return (<i>Significant negative relationship</i>) - Lagged standard deviation of security residual returns (<i>Significant positive relationship</i>)

Appendix 4 (Continued)

Author[s] (Year of study)	Sample size Country (Period examined)	Focus (Statistical technique(s))	Independent variables (The relationship with risk)
Md. Rus and Abdullah (2005)	36 distressed, 36 non-distressed, and 10 hold-out firms Malaysia (1990-2000)	Financial distress risk (Discrete-time hazard model)	<ul style="list-style-type: none"> - Firm size measured by the natural log of total assets (<i>Significant positive relationship</i>) - Financial leverage measured by debts ratio (<i>Significant positive relationship</i>) - Liquidity measured by: <ul style="list-style-type: none"> * Cash to total assets (<i>Significant positive relationship</i>) * Cash to current liabilities (<i>Significant negative relationship</i>) * Current ratio (<i>Significant negative relationship</i>) - Growth measured by: <ul style="list-style-type: none"> * Net income growth (<i>Significant positive relationship</i>) * Sales growth (<i>Significant negative relationship</i>) - Interest coverage (<i>Significant negative relationship</i>) - Profitability measured by return on assets (<i>Significant positive relationship</i>)
Strotmann (2007)	2605 firms Germany (1981-1994)	Bankruptcy risk and firm's survival (Cox proportional hazards model, grouped duration model, and AFT model)	<ul style="list-style-type: none"> - Firm's age (<i>Failure increases significantly after start-up, reaches its maximum after one or two years and decreases significantly afterwards</i>) - Industry minimum efficient scale (<i>Significant positive relationship</i>) - Industry demand (<i>Significant negative relationship</i>) - Market width (<i>Significant negative relationship</i>)
Abdullah et al. (2008)	26 distressed, 26 non-distressed, and 20 hold-out firms Malaysia (1990-2000)	Financial distress risk (Independent samples t-test, forward stepwise binary logit analysis, forward stepwise multiple discriminant analysis [MDA], discrete-time hazard model)	<ul style="list-style-type: none"> - Firm size measured by the natural log of total assets (<i>Insignificant relationship</i>) - Financial leverage measured by debts ratio (<i>Significant positive relationship based on all models used</i>) - Liquidity measured by : <ul style="list-style-type: none"> * Cash to total assets (<i>Insignificant relationship</i>) * Cash to current liabilities (<i>Significant negative relationship based on t-test</i>) * Current ratio (<i>Significant negative relationship based on t-test</i>) - Growth measured by: <ul style="list-style-type: none"> * Net income growth (<i>Significant negative relationship based on t-test and discriminant analysis</i>) * Sales growth (<i>Insignificant relationship</i>)

Appendix 4 (Continued)

Author[s] (Year of study)	Sample size Country (Period examined)	Focus (Statistical technique(s))	Independent variables (<i>The relationship with risk</i>)
Campbell et al. (2008)	1695036 observations (including 797 bankruptcy and 1614 financial distress event observations) US (1963-2003)	Financial distress and bankruptcy risks (Binary logit analysis and t-test)	<ul style="list-style-type: none"> - Interest coverage (<i>Insignificant relationship</i>) - Profitability measured by: * Return on assets (<i>Significant negative relationship based on the results of t-test and logit model, and significant positive relationship based on the results of the hazard model</i>) * Return on equity (<i>Insignificant relationship</i>) * Accounting based variables (based on the logit model): - Financial leverage measured by total liabilities to total assets ratio, and total liabilities to the sum of market equity and book liabilities (<i>Significant positive relationship</i>) - Liquidity measured by the ratio of cash and short-term assets to the market value of assets (<i>Significant negative relationship</i>) - Growth measured by market-to-book ratio (<i>Significant positive relationship</i>) - Profitability measured by net income to total assets and the moving average of net income to market-valued total Assets (<i>Significant negative relationship</i>)
			<ul style="list-style-type: none"> * Market-based variables (based on the logit model): - The relative firm size measured as the log ratio of market capitalization to that of the S&P 500 index (<i>Differs based on the model employed</i>) - The monthly log excess return relative to the S&P 500 index (EXRET) (<i>Significant negative relationship</i>) - The moving average of EXRET variable (<i>Significant negative relationship</i>) - The standard deviation of daily stock return over the past 3 months (<i>Significant positive relationship</i>) - Log price per share truncated above at \$15 (<i>Significant negative relationship</i>) * Other variables (based on t-test) - Institutional ownership, analyst coverage, and turnover ratio (<i>Significant negative relationships with financial distress risk after controlling for firm size</i>)

Appendix 4 (Continued)

Author[s] (Year of study)	Sample size Country (Period examined)	Focus (Statistical technique(s))	Independent variables (<i>The relationship with risk</i>)
Esteve-Pérez and Mañez-Castillejo (2008)	2028 firms Spain (1990-2000)	Bankruptcy risk and firm's survival (Kaplan-Meier, Cox proportional hazards model, and AFT model)	<ul style="list-style-type: none"> - Advertising and R&D (<i>Significant negative relationship</i>) - Firm's age (<i>Failure increases significantly up to about 20 years of trading, and then decreases to a certain point. Then, it increases again.</i>) - Firm size (<i>Significant negative relationship</i>) - Productivity (<i>Significant negative relationship</i>) - Price-cost margins (<i>Significant negative relationship</i>) - Export activities (<i>Significant negative relationship</i>) - Foreign participation (<i>Significant negative relationship</i>)

APPENDIX 5

The Venture Capital Firms Working in Egypt Ordered Based on the License Date

No	Firm name	License date
1	El Kahera El Watania Investment	27-03-1994
2	Misr Financial Investments	12-04-1994
3	El Ahli Investment and Development	23-04-1995
4	Khalegia Financial Investment	25-09-1995
5	Misr Exterior Financial Investments (MEFI)	21-10-1997
6	Youth National Investment & Development	10-01-1998
7	Egyptian Kuwaiti Holding	18-03-1998
8	Al Araby for Investment	6-05-1998
9	Commercial International Investment Company (CIIC)	11-05-1998
10	Misr Contracting (INCO MISR)	23-06-1998
11	A.D.I. Tourism Development and Real Estate	17-08-1998
12	Fincorp Investment Holding	24-09-1998
13	EgyCap Investment	27-12-1998
14	Egyptians Abroad for Investment & Development	18-08-1999
15	Investia Venture Capital	27-02-2000
16	Bloton Holding	4-11-2007
17	Piraeus Investment Egypt	27-11-2007

Source: Capital Market Authority (CMA)