2008

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http://hdl.handle.net/10026.1/382

http://dx.doi.org/10.24382/4372
University of Plymouth

THE DIVIDEND BEHAVIOUR OF NYSE-LISTED BANKS WITHIN AN OPTIMAL CONTROL THEORY FRAMEWORK

By

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A thesis submitted to the University of Plymouth

In partial fulfilment for the degree of

DOCTOR OF PHILOSOPHY

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SEPTEMBER 2008

AUTHOR'S DECLARATION

During the registration for the degree of doctor of Philosophy the author has been registered for the LTHE course with the University of Plymouth. The LTHE course was successfully completed in March 2006.

This study was financed partly by the University of Plymouth and partially by the author.

The following activities, pertaining to the programme of related study, have been undertaken:

1. Attendance and participation at PhD symposiums during which research work was presented
2. Attendance of various Accounting and Finance conferences and relevant literature obtained.

Total number of words in this thesis is 43 270 words.

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The dividend behaviour of NYSE-listed banks within an optimal control theory framework

ABSTRACT

Within the dividend policy literature there is no universally accepted model to explain dividend behaviour. The theoretical dividend policy literature contains a promising dynamic mathematical model based on optimal control theory formulated by Davidson (1980), in the spirit of the Modigliani-Brumberg-Yaari types of lifecyle hypothesis, but despite being published some time ago the model has not been tested empirically, possibly due to its complexity. It is the main purpose of this research study to investigate the dividend behaviour patterns of banks listed on the NYSE within this optimal control theory framework.

This work unfolds in three stages as follows: initially the impacts of the different control planning horizons in determining dividend patterns are examined. Secondly, the factors that govern the control-theoretic dividend patterns are established. Finally the factors that are associated with out-performers of the control theory framework are identified.

Appropriate and relevant data from NYSE banking corporations were obtained to test the effectiveness and efficiency of the control theory framework. The application of logistic regression analysis and logistic step-wise regression established the factors that govern the control-theoretic dividend patterns. The application of multiple regression analysis and step-wise regression analysis enabled this study to determine the factors that are associated with out-performers of the control theory framework.

Research findings suggest that the long planning horizon model tends to be good explanator of observed dividends, suggesting that the dividend decision is not constrained by short or medium term predicted liquid asset levels. NYSE banks with control-theoretic dividend patterns were associated with the smaller banks, which perform financially well and display a strong share price record, as indicated by the high Tobin's Q ratio, strong dividend yield, a greater return on capital invested, higher leverage, and a smaller number of employees. The NYSE banks with observed dividends that out-perform the control theory framework are associated with banks that have higher profits, as indicated by the higher return on equity, and an implied expanding customer base, as suggested by the higher revenue growth rate. Out-perfoming banks also have higher dividend yields, constrained by an implied internally imposed conservative retention policy, as indicated by lower payout ratios and they tend to be smaller in size.

Further research in this area is required to investigate the dividend behaviour of organisations operating on other stock markets around the world, and should help to unlock the full potential that is offered by a control theory framework.

TABLE OF CONTENTS

CHAPTER 6: IDENTIFYING THE FACTORS THAT GOVERN NYSE BANKS WITH CONTROL-THEORETIC DIVIDENDS

CHAPTER 7: IDENTIFYING THE FACTORS THAT ARE ASSOCIATED WITH BANKS THAT OUT-PERFORM THE CONTROL THEORY FRAMEWORK

CHAPTER 8: THESIS CONCLUSIONS AND DIRECTION OF FUTURE RESEARCH

LIST OF APPENDICES

LIST OF TABLES

LIST OF DIAGRAMS

DEDICATION

I dedicate this thesis to Doctors Sarah and William Adams.

All your good work Sarah and Will is acknowledged and appreciated. Undoubtedly you have contributed significantly in transforming other people's lives in a unique and admirable way. Thank you very much for the contribution that you have made in my life and my family's life. I am truly grateful. Best wishes to you all.

I also take this opportunity to promote and encourage all forms of good work carried out which are aimed at enhancing life.

ACKNOWLEDGEMENTS

Ndino tenda Mwari ishe wedu.
Special thanks to God our Lord for enabling me to complete this thesis.

My greatest gratitude goes to my first supervisor Professor John Pointon for his superb support and commitment to my success while I undertook this project. His guidance was outstanding and excellent. I learnt a lot about how to conduct research effectively from him. Thank you very much Professor John Pointon, you are greatly appreciated.

Thanks also go to my second Supervisor Dr. Sue Farrar for the numerous helpful comments and guidance. Special thanks to Mrs Fiona Dalton for her supportive comments. It is thanks to her past work on dividend policy with Professor John Pointon that I became aware of possible research questions on dividend policy.

I am also thankful to my husband Dr. William Mukonoweshuro, for being such a superb advisor and for being so patient in reviewing and editing my work. Your fantastic contribution is much appreciated William.

My children Tafara and Ruvimbo gave me amazing support throughout the whole period of this PhD programme. Thank you, Tafara and Ruvinbo for all your prayers, good wishes and encouragement.

I am especially grateful to my father Mr Oliver Ushendibaba and mother Mrs Venacia Ushendibaba who always believed that I was capable of completing such a project successfully.

Warm gratitude also goes to my two good and loving sisters Mary and Tendai, my husband's parents Mr. Piniel and Mrs Faith Mukonoweshuro, my friends and colleagues for their never ending moral support and encouragement.

ABBREVIATIONS

Chapter 1

MM (1961)	Miller and Modigliani (1961)

Chapter 2

β	Beta (Systematic risk)
CAPM	Capital asset pricing model
D	the dividend paid in the current year
DCF	Discounted cash flow method
EPS	Earnings per share
g	the expected dividend growth rate
Ke	Cost of Capital
P	the current share price
R_F	Risk free rate

Chapter 3

A_0	Liquid assets, at the beginning of planning period at time zero = Working Capital (initial asset position)
Y_0	Income before dividends at beginning of planning period at time zero
D_0	Dividends at the beginning of planning period at time zero
A_t	Liquid assets (working capital) at time t
β	Beta (Systematic risk)
σ	Sigma = return on capital employed
ρ	Rho = Ke - Cost of capital (managerial time preference rate)
g	Growth rate of income
i	$(\sigma - \rho) / \varepsilon$
j	$(g - \sigma)$
T	the planning horizon date, $t \in [0,T]$
t	Control planning horizon (time)
U	Utility function
U (D(t))	Dividend utility function
U'	= derivative of U (D(t)) w.r.t. D(t) , (gradient of the dividend utility function)
U''	second derivative of U (D(t)) w.r.t. D(t) , (gradient of U')
W	Weighting function
W (A(T))	Weighting function for terminal liquid assets (weighted stock of liquid assets at time T)
W'	= derivative of W (A(T)) w.r.t. (A(T)) ,(gradient of the weighting function of liquid assets)
W''	second derivative of W (A(T)) w.r.t. (A(T)) , (gradient of W')
η	*(Eta)*, elasticity of marginal utility in relation to terminal assets A (T), where $\eta > 0$. *(Note: there is no reason why this should be upper bounded at*

unity. This is a misspecification in Davidson (1985). The main point at issue is that the isoelastic form of the utility function cannot apply when the elasticity equals one, at which point the logarithmic form is correct.)

ε	*(Epsilon)* , elasticity of marginal utility in relation to dividends d(t), where $\varepsilon > 0$. *(In some stochastic models, this is also the coefficient of relative risk aversion (RRA)).*

Chapter 4

See list of abbreviations and symbols for chapter 4 above

ADVFN	Advanced financial network
OCTM	Optimum Control Theory Model
RW	Risk weights
RWA	Risk weighted assets
RFW	Risk free weights
RFA	Risk free assets

Chapter 5

NYSE	New York stock exchange
DD	Dividend divergence
DDF	Dividend divergence figure
DDR	Dividend disparity rate
T	Control planning horizon

Chapter 6

See list of abbreviations and symbols for chapter 6 above

p	Probability of 'success' (i.e. suitability)
1-p	Probability of 'failure' (i.e. non-suitability)

Chapter 7

See list of abbreviations and symbols for chapter 6 and 7 above

Chapter 8

NYSE	New York stock exchange
β	Beta (Systematic risk)
CAPM	Capital asset pricing model
D	the dividend paid in the current year
DCF	Discounted cash flow method
EPS	Earnings per share
g	the expected dividend growth rate
Ke	Cost of Capital
MM (1961)	Miller and Modigliani (1961)
P	the current share price
R_F	Risk free rate
OCTM	Optimal Control Theory Model

CHAPTER 1: THE RESEARCH OVERVIEW

1.1 Introduction

Chapter 1 contains the introduction to this thesis. It is divided into the following sections: Section 1.2 sets out the key issues that are investigated in this thesis and the importance of this research study. Section 1.3 outlines the structure of this thesis, and finally Section 1.4 concludes the chapter.

1.2 Key issues and importance of the research

Currently in the dividend policy literature there is no universally accepted model to explain dividend behaviour. However, dividend policy literature contains one promising mathematical model developed by Davidson (1980) based on an optimal control framework. However, this dividend determination model has not been tested empirically. It is the main purpose of this research study to subject this optimal control model to testing.

The optimal control theory model has the advantage of being dynamic in nature (ie optimising across multiple time periods) rather than static. The nature of one of the key state variables, ie the liquid assets variable, makes the optimal control model well suited, prima-facie, to the banking industry as liquid assets are fundamental asset to banking corporations. In the control theory model, any liquidity contraints that take the form of either explicit terminal values at the planning horizon, or a trade-off between the liquid asset and dividend levels, will give a significant weighting to the asset values when estimated over time. Where this is not the case, dynamics more closely related to the Lintner type of partial adjustment models (based only on earnings and lagged dividend) will result. The NYSE banks were selected also because of data availability, the large sample size, a spectrum of types of banks, and the NYSE stock market being the largest in the world by market capitalisation.

This research study is also important because it is in response to the calls made in the literature which have urged researchers to examine further dividend determining models. Collins, Saxena and Wansley (1996), specifically called researchers to empirically conduct research into the area of dividend determination as some of the advanced models that have been successfully developed to determine dividends still remain untested. Davidson (1980) also called for empirical tests to be carried out on the optimal control theory framework for dividend determination. Although Davidson's work in this area is not recent, the perspective taken in this thesis is that it offers useful insights into a modern economic environment that have been largely overlooked. This particular research study, therefore, is a response to Davidson's (1980) appeal.

Little work has been conducted on dividend determination of banks, and also Davidson's model had not been tested in this context, so the challenge here is to investigate the extent to which his model explains the dividend behaviour of banks listed on the NYSE. Therefore, all the key results of this research, contained in Chapters 5, 6 and 7, enhance the current knowledge regarding the practical effectiveness and efficiency of the optimal control theory framework for dividend determination.

The importance of conducting research on dividend policy was identified by Miller and Modigliani (1961) who stated that the dividend policy of an organisation is particularly of importance to company directors because they set policies, to investors because they have to plan portfolios, and to economists because they seek to understand how capital markets function.

Interest in optimal control for dividends has been sparked off by two very recent studies that were not published when this research work began. The following two brief examples demonstrate the interest that researchers have in developing dividend determining models and further work is required to move this process forward:

- Cadenillas, Sarkar, and Zapatero (2007) successfully modelled the optimal dividend strategy as a stochastic impulse control problem. They also found a formula for the expected time between dividend payments. A crucial and surprising result of their paper is that, as the dividend tax rate decreases, it is optimal for the shareholders to receive smaller but more frequent dividend payments.
- Cadenillas, Choulli, Taksar and Zhang (2006) present the classical and impulse stochastic control model for dividend optimisation for a financial or an insurance entity which can control its business activities. The classical and impulse stochastic control model can enable the firm to reduce the business risk. The model presented controls the timing and the amount of dividends paid out to the shareholders.

1.3 Structure of the thesis

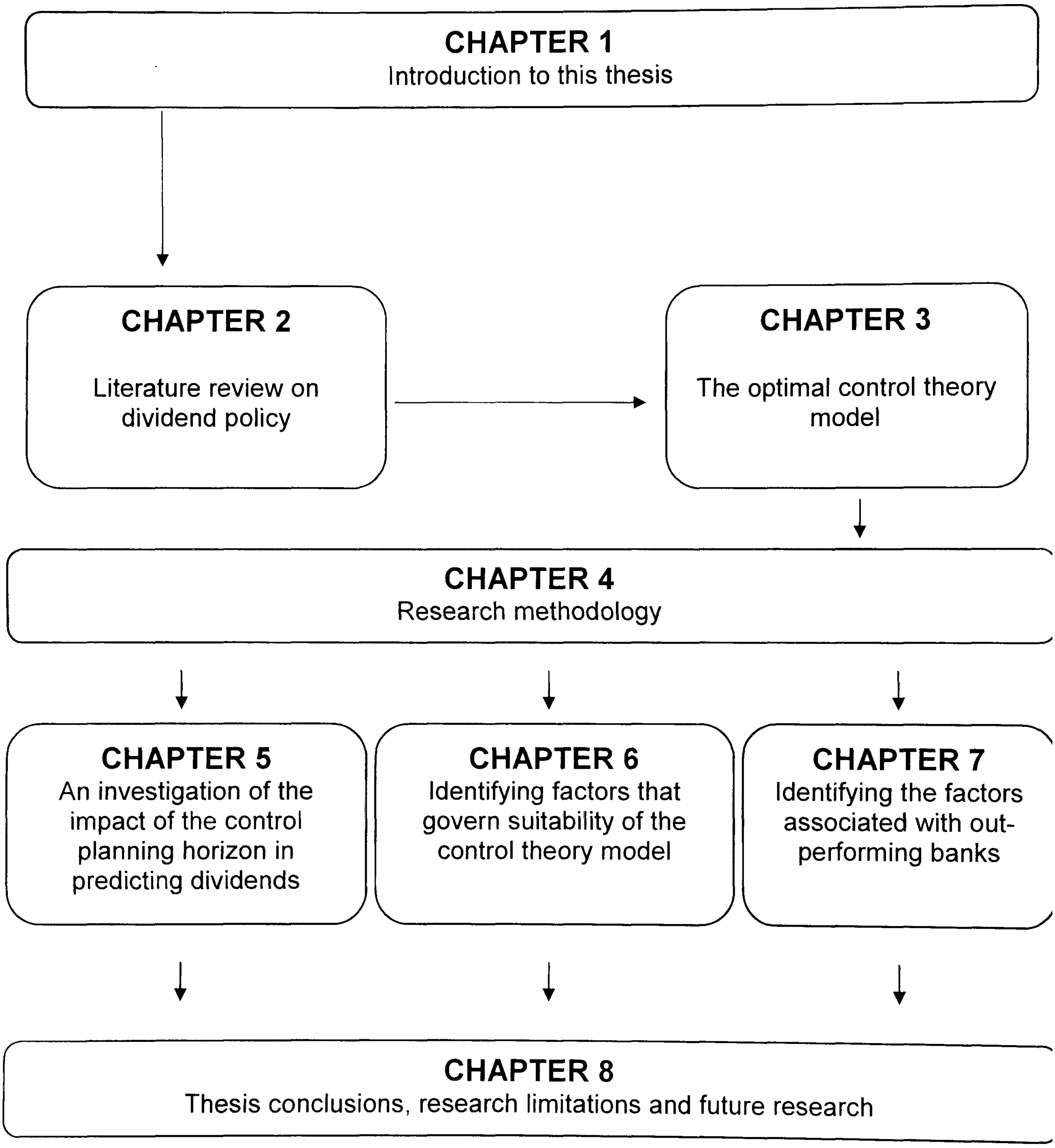
This study unfolds in three stages. The initial phase (first stage) involves investigating the impact of the control planning horizons and establishing the control planning horizon for each NYSE bank. Full details of the work carried out in stage one, and the results of this aspect of the research, are contained in Chapter 5 of this thesis.

The intermediate phase (second stage) of this study applies the advanced logistic regression analysis and advanced logistic stepwise regression analysis to identify whether there are key factors that govern the suitability of the optimal control theory model for dividend determination. The presence of the identified factors in a NYSE – listed banking corporation would indicate that the bank has a good chance of being able to apply the optimal control theory model for dividend determination successfully. Chapter 6 contains relevant information regarding the work carried out in the intermediate phase of this research project.

The final phase (third stage) in Chapter 7 identifies the factors that explain the charecteristics of out-performing banks. The application of multiple regression analysis and stepwise regression enables this study to identify the required factors effectively.

Diagram 1.3 below details the structure of this thesis

Diagram 1.3 - The thesis structure



This thesis is divided into eight different chapters as clearly displayed in Diagram 1.3 above.

This thesis has been introduced in Chapter 1 which gives a brief overview of the research project. Chapter 2 reviews published literature on dividend policy. Chapter 3 presents the optimal control theory framework as presented by Davidson (1980). The research methodology applied to conduct this research study is detailed in Chapter 4.

Details of the practical work carried out and findings attained in this research project are contained in Chapter 5 through to Chapter 7. Thus, Chapter 5 investigates the impact of the control planning horizons in predicting dividends, while Chapter 6 identifies the factors that govern suitability of the control theory model and Chapter 7 ascertains the factors that are associated with out-performing banks.

1.4 Conclusion

Chapter 1 has set the scene for this research study by:

- detailing the key aims of this research project,
- specifying the key reasons which motivate this research work, and
- presenting the structure of the thesis.

CHAPTER 2: LITERATURE REVIEW ON DIVIDEND POLICY

2.1 Introduction

The aim of Chapter 2 is to present the relevant published literature on dividend policy. Chapter 2 is divided into five parts. Section 2.2 defines dividend policy. Section 2.3 identifies and dicusses some key issues in dividend policy. Section 2.4 identifies the main factors that past research presents as factors that influence dividend policy. As very little research has been done to investigate specifically the dividend policy of US banks Section 2.5, discloses and discusses the findings from research that has been conducted only on US banking corporations' dividend policy. The findings of Section 2.5 will be compared to the general literature on dividend policy and relevant similarities and differences noted. Finally Section 2.6 concludes Chapter 2.

2.2 What is dividend policy?

A dividend is simply defined by Sutton (2004) as a distribution to the firm's shareholders, usually from its profits and in cash.[1] Directors of companies are also confronted with a dilemma of whether or not to offer non-cash dividends to shareholders or offer share buy backs. Non-cash dividends and share buy backs have been reported to be on the increase and further discussions of share buy backs are contained in section 2.3.11 of this thesis.

Dividend policy is the guidelines and procedures that a company follows to decide how much it will pay out to shareholders in dividends. [1,2]

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[1] Sutton, T. (2004), Corporate financial accounting and reporting, Prentice Hall- Financial Times, second edition.

[2] Van Horne, J.C.(1995), Financial Management and Policy, Tenth edition, Prentice Hall International Edition.

A company decides whether to retain the profits made within the company, or to pay profits out to the owners of the firm in the form of dividends. Once the company decides on whether to pay dividends, they may establish a somewhat permanent dividend policy, which may in turn impact on investors and analysts' perceptions. What they decide depends on the assessed situation of the company now and in the future. It also depends on the preferences of investors and potential investors.[3]

A dividend is distributed to shareholders on a specific date. When a dividend is declared it becomes a current liability of the firm and cannot be rescinded (cancelled).

[3] Lumby, S. and Jones, C. (2003), *Corporate Finance Theory and Practice,* 7th Edition Thomson.

Table 2.2 The method of dividend payment - An example

Thursday 15th January Declaration date	Friday 26th January Ex-dividend date	Friday 30th January Record date	Monday 16th February Dividend payment date
The board of directors declares a payment of dividends.	A share is sold ex-dividend on this date. The seller is entitled to keep dividends. Under the NYSE rules shares are traded ex-dividend on and after the fourth business day before the record date. (Investors should buy before this date if they want the dividends).	This is the date on which the company reviews its records to establish the shareholders of the company. An investor must be listed on this date as a 'holder of record' to have the right to dividends. A 'holder of record' is the person named on the company register as the owner of a security who has the right to dividends.	The dividend cheques are mailed to shareholders on record.

2.3 Key challenges in dividend policy

The following are the different challenges that the literature has identified as facing dividend policy considerations.

2.3.1 Issues of modelling dividend behaviour

Little success has been achieved in using theories such as signalling and agency to build models that explain observed dividend behaviour. According to Davidson (1980), the dividend models that have been reported to give disappointing results are the frameworks that are constructed to maximise the value of the equity interest in a company, for which the policy function in these models are linear in the present value of dividends and this leads to linear Hamiltonians, which give 'bang bang' solutions except in the cases of 'microscopic degeneracy' (ie when a whole range of payouts are equally valued).

Dividend policy literature contains some complex and some simple models that work reasonably well in explaining the change of dividends within companies over time. Some interesting simple empirical time series models that have potentially shown ability to explain dividend behaviour are the partial adjustment (PA) model, formulated in 1956 by Lintner, distributed lag (DL) model, formulated in (1954) by Koyk and adaptive expectations (AE) model, formulated in 1958 by Nerlove.

The three simple time series models the PA, DL and AE are all important to this research study; firstly, because they are dynamic models just like the optimal control theory framework presented by Davidson (1980) and they all determine the behaviour of dividends over time, but yet they are different models in nature. The three simple time series models mentioned above are all ad hoc empirical dynamic models, whereas the optimal control theory framework discussed in chapter 3 of this thesis is a theoretical dynamic model consistent with the managerial framework proposed by King (1977).

Secondly, the partial adjustment and the adaptive expectations models are important to this thesis, because the intertemporal changes of dividends in the optimal control theory framework presented by Davidson (1980) can be expressed in a way that exhibits similarities to the reduced form time series equations of these empirical models, which perform quite well in explaining dividend changes between periods. The control theory model thus provides some interesting explanations (or parameterisations) of the reduced from coefficients. Chapter 3, section 3.3, details how the reduced form time series equations have been utilised in the control model to establish such intertemporal changes of dividends.

Davidson (1986) states that the PA, DL and AE models give reduced form equations that are equivalent, from the perspective of conventional estimation, so essentially they are regarded as being indistinguishable. The DL and AE models are themselves structurally the same and are both of similar form, but the structure of the DL and the AE models are not identical to the structure of Lintner's PA model. The reduced form equations of DL and AE are mainly distinguishable from the PA only by the presence of a serially correlated error term and the absence of a constant term.

The reduced form equations of the PA, DL and AE are as follows:

- **Lintner's (1956) PA model**

Lintner (1956) based his partial adjustment model on interviews with the management of 28 industrial companies, which were selected for their diverse financial characteristics. The partial adjustment model states that when the directors set a dividend they have in mind a target dividend level. Now,

D_{it}^* = the target dividend payout, i.e. the proportion r_i of the actual level of earnings E_{it}, and

r_i = the target payout ratio.

Therefore:-

$D_{it}^* = r_i E_{it}$ = target dividend ....(i)

The target dividend level mentioned above adjusts partially to the actual dividend level, according to the partial adjustment equation:

$D_{it} - D_{it-1} = a_i + c_i(D^*_{it} - D_{i,\,t-1}) + U_{it}$ ....(ii)

where:

a_i= constant, which, as Lintner (1956) states, captures a reluctance by the directors to reduce dividends.

c_i= a constant ($0 < c < 1$) to reflect the speed at which actual dividend levels are adjusted by the directors to reach the target dividend level.

U_{it} = is a random error term.

Now, eliminating the target dividend level from equation 2 using equation 1 gives equation 3, below

$$\Delta D_{it} = a_i + c_i r_i E_{it} - c_i D_{i,t-1} + U_{it} \quad \text{.......................... (iii)}$$

Equation 3 above simplifies to the form below:

$$\Delta D_{it} = \beta_0 + \beta_1 E_{it} + \beta_2 D_{i,t-1} + U_{it} \quad \text{................................ (iv)}$$

Where:

D_{it} = dividend at time t

β_0 = constant

β_1 = $c_i r_i$ = product of speed, at which actual dividend levels are adjusted by the directors to reach the target dividend level, and target payout ratio

E_{it} = Earnings at time t

β_2 = -c = minus speed at which actual dividend levels are adjusted by the directors to reach the target dividend level.

Hence $c = -\beta_2$ and $r = -\beta_1 / \beta_2$

$D_{i,t-1}$ = dividend at time t-1, and

U_{it} = is a random error.

Some assumptions that were made in the PA model by Lintner in 1956 were also adopted by Davidson 1980 in his optimal control theory framework and these include:

- Lintner assumed income to be exogenously determined and the income component Y(t) in Davidson's optimal control theory framework was treated as exogenous.
- Lintner observed that investment policy seemed to have very little influence on dividends. Investment policy is considered by Davidson's control theory implicitly. The assumption of not explicitly considering investment policy is consistent with Fama's (1974) findings.

Davidson (1986) finds that the partial adjustment (PA) model has some fundamental weaknesses. For example, the theoretical basis of the model is too simple and not robust enough as it does not incorporate the other key elements that are likely to influence dividend determination. Certainly the absence of a variable, such as the liquid assets, makes the partial adjustment model possibly unsuitable, prima facie, to the banking industry as liquid assets are fundamental assets to banking corporations. Researchers such as Davidson (1986) who extensively carried out empirical studies on the simple time series models such as the adaptive expectations, partial adjustment, and distributed lags models have concluded that observed dividends tend to adjust much less frequently than Lintner's model would suggest and that the implied loss function would result in zero parameter values. Also, the constant parameter in the model does not have a simple interpretation given to it (ie a 'reluctance to reduce dividends'), and the payout values determined by the PA model can conflict with the empirical evidence.

The above partial adjustment model by Lintner (1956) has the ability to explain aggregate dividend levels for companies, and the model attempts to explain dividend behaviour and does not add much theory to the underlying relevant literature on dividend determination. Gven some of these limitations to the PA model, this research study will focus on the optimal control theory model instead which, prima facie, would seem to possess more potential, when applied to the banking industry, especially considering its treatment of liquid assets.

- **Koyk's (1954) Distributed Lag Model:**

The hypothesis of Koyk's (1954) distributed lag model views current dividends as a weighted series of current and past earnings.

Therefore:

$D_t = \gamma_0 \; E_t + \gamma_1 \; E_{t-1} + \ldots + U_t$ ....(v)

where:

D_t = dividend in time t

$\gamma_0, \gamma_1, \ldots$ = weighting coefficients

E_t = earnings in time t

E_{t-1} = earnings in time t-1

U_t = error term

A large number of the lagged independent variables above are most likely highly collinear and because of this the above equation (v) may not be very useful as it stands.

To make equation (v) above more tractable, some assumptions have got to be made regarding the explanatory variables. If the weights are assumed to be related by a simple exponential decay factor so $\gamma_{t-1} = \gamma_t \, . \, h$ (where $0 < h < 1$) then the following distributed lag model results:

$\Delta \; D_t = \gamma_0 \, E_t - (1\text{-}h) \, D_{t-1} + U_t - h \, U_{t-1}$ ....(vi)

This distributed lag model, as in equation (vi) above is sturctually similar to the adaptive expections model below (equation (ix)). Equation (vi) (DL) model differs from Lintner's model (equation (iii)) in terms of the serially correlated error process contained by the DL model and the absence of the constant value which is present in the PA model.

- **Nerlove's (1958) Adaptive Expectations Model:**

Nerlove's AE model assumes that the firm's actual dividends D_t are a fixed proportion k of the long run earnings $E^L{}_t$ with an error term U_t

therefore:

$D_t = k\ E^L{}_t + U_t$ ....(vii)

The long run earnings expectations are assumed to adjust accordingly as follows:

$E^L{}_t - E^L{}_{t-1} = e\,(E_t - E_{t-1})$ ....(viii)

In equation (viii) above, e is the coefficient of the long run earnings expectations.

The unobservable variables are eliminated and rearranging equation (vii) above in terms of $E^L{}_t$, substituting in equation (viii) and rearanging gives the following adaptive expectations model equation:

$\Delta D_t = ek\,E_t - k\,D_{t-1} + U_t + (k-1)\,U_{t-1}$ ....(ix)

The AE model contained in equation (ix) above is structurally similar to the DL model contined in equation (vi) and the AE also produces similar results to the PA model contained in equation (iii), however, the AE equation is not totally identical to equation (iii) of the PA model.

2.3.2 Difficulties faced by company directors

Davidson (2002) confirms that directors of both public and private limited companies experience difficulties when:

1. determining the appropriate level of dividends to be paid to shareholders,
2. deciding whether or not to offer non-cash alternatives such as scrip dividends.

He argues that these problems facing directors are not fully addressed in the literature on dividend policy for it does not offer unified best practice guidelines to company directors, when formulating corporate dividend polices. Since the dividend puzzle remains unsolved and the literature is disjointed and contradictory, the difficulties remain. Indeed, developing a unified rational corporate dividend policy is still a challenge facing finance academics even today. More work aimed at unifying dividend policy theory is required. The intention in this thesis is to apply the control theory model and establish to what extent it can explain dividend behaviour within a banking environment, hopefully creating new insights into this puzzle.

2.3.3 The irrelevance of dividend policy in theory

Miller and Modigliani (also known as MM) (1961) suggest that dividend policy is irrelevant in finance theory in a perfect tax - free capital market environment. This irrelevance theory argues that changes in dividends do not determine the value of the company in a perfect market. Miller and Modigliani's (1961) work suggests that it is the ability to generate earnings that ultimately determines the value of the company. The assumptions in Miller and Modigliani's (1961) analysis are that any new capital raised is on equivalent terms to retained earnings (the new capital is issued at its correct valuation with no issue costs incurred and new capital is a perfect substitute for retained earnings) and the firm's investment activities are independent of its dividend policy. Therefore, since the retained earnings and new equity are perfect substitutes this leaves dividends undetermined by any given investment plan because new capital can always be raised when it is required for investments. MM's analysis is confined to all equity firms, whose investment plans are predetermined and known by all market participants.

The irrelevance hypothesis put forward by MM (1961) is a logical extention of the position established in Modiglian and Miller (1958). MM's (1958) work on capital structure showed that under some implicit assumptions the value of a company is unaffected by the relative proportions of debt and equity in the company's capital structure. MM's (1958) research implicitly assumed that the debt and equity proportions in the capital structure do not affect the investment decision, as the new finance required is readily available from external sources.

MM established, in the two papers mentioned above, that under the implied and idealized assumptions we can conclude that the investment (company's investment portfolio and share value), financing (debt and equity) and dividend decisions of a company are disjointed from each other and can be made independently. Therefore, according to MM any changes in the current dividends that the directors make are assumed not to affect the amount of capital available for investments as the firm is assumed above to get the new finance required from external sources, which are assumed to be readily available. MM ensures that all investments planned can be met under the irrelevance theory.

MM's (1961) irrelevance theory is logical and consistent within a perfect market but the world is not a perfect market place and therefore the irrelevance theory does not help either:

- the theorist seeking to explain the behaviour of observed dividends or
- the practitioners (directors of organisations) who might seek information or assistance regarding determining the appropriate level of dividends to pay to shareholders.

Management accounting studies (Horngren, Bhimani, Datar and Foster (2005), on investment appraisal techniques support MM's conclusions by utilising the relevant cash flows associated with the proposed project without simultaneously assessing how the proposed project will affect the financing (capital structure) and dividend policies of the company, (see Davidson, 2002).

Bar Yosef and Kolodny (1976) state that when considering the textbook treatment of the Capital Asset Pricing Model (CAPM) it is consistent with MM's conclusions by assuming dividend irrelevance implicitly, since CAPM rates of return make no distinction between dividend returns and capital gains.

2.3.4 The practical relevance of dividend policy and the impact of dividends on share price

Gordon (1962) takes the position that dividends are relevant to the market valuations. The literature on dividend policy identifies Gordon's work with the 'traditional' view which states that dividend policy has incremental valuation effects on the market share prices. Gordon's (1962) growth model was developed based on Williams' (1938) findings and together the two valuation models demonstrate the relationship that exists between dividends and share valuation. Williams' (1938) and Gordon's (1962) models equate the market price of a share with the present value of expected future dividends growing at a constant rate. The valuation models predict that any independent changes in the expectation of some future dividend would have an immediate effect on the market value of the company.

It is believed that a company's flow of future dividends is likely to be a more complex pattern than the pattern assumed by Gordon (1962). In the simplified model, the future pattern of share's dividends grows at a constant annual rate, in perpetuity. The dividend growth model below confirms the relevance of dividends in the determination of market share price.The calculations below also show how Gordon's 'dividend growth' model is derived.

The dividend growth Model

Key:

d_0 = current dividend per share (i.e. at time t_0 - time now)

d_1 = expected dividend per share in 12 months' time (i.e.t_1)

K_E = cost of equity capital

P_E = ex div market price per share

g = constant annual growth rate of dividends

b = proportion of the year's earnings that are reinvested

r = rate of return of reinvested earnings

$$P_E = d_1 / (1 + K_E) + d_1 (1 + g) / (1 + K_E)^2 + d_1 (1 + g)^2 / (1 + K_E)^3$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; d_1 (1 + g)^{N-1} / (1 + K_E)^N \qquad \textbf{(i)}$$

multiplying each side by $(1 + g) / (1 + K_E)$ gives,

$$P_E (1 + g) / (1 + K_E) = d_1 (1 + g) / (1 + K_E)^2 + d_1 (1 + g)^2 / (1 + K_E)^3$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; d_1 (1 + g)^N / (1 + K_E)^{N+1} \qquad \textbf{(ii)}$$

subtracting equation (2) from equation (1) gives,

$$P_E - P_E (1 + g) / (1 + K_E) = d_1 / (1 + K_E) - d_1 (1 + g)^N / (1 + K_E)^{N+1} \qquad \textbf{(iii)}$$

as long as $K_E > g$ then , as N approaches infinity so, $d_1 (1 + g)^N / (1 + K_E)^{N+1}$ approaches zero and therefore,

$$P_E - P_E (1 + g) / (1 + K_E) = d_1 / (1 + K_E) \quad \textbf{(iv)}$$

multiplying equation (iv), by $(1 + K_E)$ gives,

$$P_E (1 + K_E) - P_E (1 + g) = d_1 \quad \textbf{(v)}$$

$$P_E (K_E - g) = d_1$$

Therefore:

$$P_E = d_1 / (K_E - g) \quad \text{or as} \quad P_E = d_0 (1 + g) / (K_E - g) \quad \text{where: } g = br \quad \textbf{(vi)}$$

From the above formulae we can derive the formula for cost of capital (K_E), therefore:

$$K_E = (d_1 / P_E) + g \quad \text{or as} \quad K_E = [\, d_0 (1 + g) / P_E \,] + g \quad \textbf{(vii)}$$

The above cost of capital formula is also called Gordon's (1962) discounted cash flow model (DCF). Cost of capital is greatly utilized in finance when making investment appraisal decisions. The above discounted cash flow model does not necessarily establish a link between dividend decisions and investment decisions of an organization as investment does not figure in the equations. The past empirical research conducted by Drymes and Kurz (1967) appears to demonstrate that a relationship exists between dividends and investments, althought the time-series work of FAMA (1974) contradicts this.

Dividend initiation announcements are associated with positive stock prices on average. For example, Asquith and Mullins (1983) reported abnormal returns of 3.7% around the announcement of dividend initiations, although similar findings persist in studies using longer and more recent sample periods, for example, Officer (2007). The higher share prices, along with the associated announcements of increases in dividend payments, are typically interpreted as implying that dividend initiations (or increases) communicate valuable, positive information to the market. In the existing literature on dividend policy, two main hypotheses (that are not mutually exclusive) have emerged to explain the nature of this information (these are discussed later in this thesis, in sections 2.3.9 and 2.4.5 respectively): (i) that dividend initiations signal higher cash-flow/profitability for initiating firms; and (ii) that dividend initiations signal lower agency costs at the initiating firm as managers will have less of their shareholders' cash to waste, both now and in the future. Officer (2007) examined the relationship between share prices and dividend initiation, corporate governance and agency costs. He finds evidence consistent with the agency cost hypothesis that dividend initiations convey valuable information to investors about the reduction in agency costs for firms with weak pre-initiation governance. Officer's research findings also revealed that firms with characteristics that are thought to represent weak internal and external governance (insider dominated boards, managers entrenched by anti-takeover provisions, and low ownership by important external monitors) or weak monitoring, and high agency cost, experience significantly positive stock price reactions to dividend initiations announcements compared with firms with strong governance and monitoring.

Officer's (2007) results suggest that firms with weak control systems (weak corporate governance) have to utilise dividend policy to substitute for their poor control systems. According to Officer's results the general market tends to see the firm's choice to initiate regular cash dividend payments as a sign of possessing robust monitoring systems and a reduction in agency costs.

In the 2007 paper, Officer shows that dividends are relevant in influencing share price. The results are also consistent with the hypothesis that dividend policy is a substitute for other governance attributes and that the market prices respond to the reduction in agency costs resulting from the initiation of dividends. Robustness tests conducted by Officer suggest that the agency cost explanation for the relation between dividend initiation announcement and governance proxies is most consistent with the data used.

In his 2007 paper, the dependent variable that Officer used is the sum of daily abnormal returns for dividend initiating firms for the 20-trading-day window beginning on day -22 (relative to the dividend initiation announcement date) and ending on day -2. The independend variables used include, for example, internal governance variables such as board size, strong board, CEO as chairman, board being insider dominated, % ownership by executive directors, % ownership by CEO, and external governance variables, including, for example, managerial entrenchment (BCF index , Bebchuk, Cohen, and Ferrell's index), % ownership by institutions, % ownership by public pension funds; other variables include leverage, sales growth, market-to-book assets, cash flow from operations and many others. Officer used cross-sectional data and applied the ordinary least squares (OLS) regression analysis accordingly.

Sections 3.4 and 3.5 below also demonstrate the relevance of dividend policy on financial matters.

2.3.5 Different perspectives of dividend policy

Merrill Lynch (1978) published a document, which stated that investors purchase stocks in order to:

1. get income (dividends)
2. get capital appreciation

3. get both 1 and 2.

However, Pike (1984) suggested that investors generally preferred to buy shares to get appreciation than to earn income. On the other hand, Graham and Dodd (1951) believe that the market trend drifts towards higher dividends. Most dividend determination models possess a variable, which captures a reluctance of firms to reduce dividends, hence demonstrating the steady drift to larger dividends. Furthermore, the optimal control theory model for dividend determination presented by Davidson (1980) tends to lead towards determining increasing dividends.

As good practice, before establishing a long term dividend policy for their organisations, company directors need to determine the key forces driving their shareholders to purchase shares.

2.3.6 Wealth transfers between shareholders and bondholders

In the literature on option theory it is suggested that 'wealth transfer' occurs when dividends are paid to shareholders. Dividends increase the wealth of shareholders at the expense of bondholders by reducing the assets' base that provides security for the bondholders. In theory the 'wealth transfer' is significant in geared organisations because paying dividends reduces the amount available for reinvesting back into the organisation in the future and hence decreases the future wealth generation and lowers the creditors' security.

In practice bondholders tend to be protected by agreed contracts that enable bondholders to receive and enjoy all the benefits entitled to them. The bondholders' covenants restrict the dividend that can be paid out to shareholders enabling bondholders to get their share of the company's revenues.

Woolridge (1983) analysed the effects of unexpected dividend changes on values of common stock, preferred stock and bonds, and concluded that a wealth transfer effect is not necessarily ruled out, but if it exists it is dominated by the signalling effects. Furthermore, a study by Gombola and Liu (1999) does not support the notion of wealth transfer from bondholders to stockholders, but provides evidence supporting the signalling hypothesis. Therefore, the above empirical research does not support the hypothesis that when dividends are paid out to shareholders this results in a wealth transfer to shareholders and a reduction in the assets' base that provides security for bondholders. Current research on this subject matter has been centred on investigating the types of situation where relationships of wealth transfers can take place and the type of bond covenant restrictions that would be needed to overcome unfair practice.

2.3.7 The effects of information availability on dividends – the signalling hypothesis

Financial announcements, such as dividends declarations, inform investors and other stakeholders of the organisation on the future prospects of the firm. Good management signals its abilities by paying higher dividends than less able management. Paying higher dividends sends a signal to the stakeholders that the company is in 'good hands'. However, Borokhovich et al's (2005) work shows that the signalling hypothesis has disappointing results when it is tested empirically.

Borokhovich et al (2005) concluded that paying dividends reduces agency costs, but find no evidence to suggest that an increase in dividend payments reduces agency costs further. When dividends are paid out the lower agency costs imply that managers of the organisation will have less of their shareholders' cash to waste both in the current and future periods.

A high dividend might be a signal of underinvestment. However, Fama and French (1998) find that dividends have an impact on the share value. Further discussions of the signalling hypothesis are contained in Section 3.4.6. of this chapter.

2.3.8 The implications of omitting dividends

In the UK until the passing of the Trustee Act, 2000, the statutory powers and duties of trustees were largely defined in the 1961 Trustee Investment Act (1961, TIA), together with the Trustee Act, 1925. Under the 1961Trustee Investments Act, a public company in the UK that failed to pay a dividend in any of the previous five years was not entitled to a wider range status. This means that the 1961 Act had, for example, restricted the use of trust funds in being invested in companies that had no dividend record in any of the five year period. Another restriction of the 1961 Act was that the trust fund had to be split into two parts comprising narrow and wide-range investments, in a maximum 25%/75% split. Due to the (1961, TIA) restrictions mentioned above, instead of paying a zero dividend most public companies were at least paying a minimal amount.

The Law Commission in 1999 highlighted the above mentioned problems that were contained in the (1961, TIA) and made recommendations for change which involved removal of some of the restrictions. The restrictions were removed accordingly by the 2000 Act, which introduced a new power of investment to replace that contained in the 1961 Act. The 2000 Act gives much wider investment powers to trustees, including trustees of pension funds. Trustees may now make any kind of investment with the exception of certain types of land. The general power of investment contained in section 3 of the 2000 Act enables trustees to invest in anything that they could have invested in if they were the absolute owner of the funds. It is now possible, for example, for trustees to invest in companies that have very poor dividend records and newly privatised utilities, which would not have conformed to the requirements of the 1961 Act, and there is no longer any requirement to divide the fund into equities and gilts. In addition to the general statutory power, there may be express powers of investment given to the trustees in the Trust Instrument itself.

However, the 2000 Act does state that it is necessary for trustees to review, on a regular basis, the investment decisions which they make and to obtain appropriate advice before making a particular form of investment. Therefore, perhaps due to the duty of care that is expected from the trustees, the trustees might select not to invest in companies that omit dividends.

The 2000 Act does not specify the regularity with which investments should be reviewed, but it has been suggested by Martyn Frost, a Manager with Barclays Bank Trust Company, that such review should be at least annually (Frost, 2001). Due to the above mentioned, regular recommended inspections are laid out that by the 2000 Act, so that trustees may pull out of companies that are omitting dividends. Thus, the Trustee Act 2000 implicitly has implications for omitting dividends.

2.3.9 Relationship between dividends and share buy-backs

Mitchell and Robinson (1999) stated that the bulk of prior research on share buy-backs has been undertaken within the US legislative environment. They observed that the perceptions of buy-backs in Australia are different to the US, and Mitchell and Robinson (1999) concluded that the motivations for on-market buy-backs are: (a) signalling of future expectations (underpricing), and (b) an attempt to increase financial performance, earnings per share (EPS) and/or enhance share position. For selective buy-backs, the main purpose is to remove specific shareholders from the share register. Employee buy-backs are generally seen as an off-market means of providing a market for the company's shares. Finally, the overriding motivation for buy-backs is as an alternative to dividends. The above shows that there are potential advantages to companies of following a share buyback policy.

Stephens and Weisbach (1998) found that share repurchases are negatively related to previous stock price performance, suggesting that firms increase their purchasing depending on the degree of perceived future undervaluation of shares. In addition, repurchases are positively related to levels of cash flow, which is consistent with liquidity arguments. Share buy backs occur in organisations that are substantially liquid.

Grullon and Michaely (2002) show that share repurchases have not only become an important form of payout for US corporations, but also for firms that finance their share repurchases with funds that otherwise would have been used to increase dividends. According to Grullon and Michaely (2002) young US firms have a higher propensity to pay cash through repurchases than they did in the past, and repurchases have become the preferred form of initiating a cash payout. Grullon and Michaely (2002) found that the large established US firms have a higher tendency to pay out cash through repurchases and generally the large firms have also not cut their dividends. Grullon and Michaely (2002) suggested that their findings mentioned above indicate that firms have gradually substituted repurchases for dividends. Before

1983, the regulatory constraints in the USA inhibited firms from aggressively repurchasing shares according to Grullon and Michaely (2002).

Grullon and Michaely (2002) confirm that, for decades in the USA, corporations have preferred to pay out cash in the form of dividends rather than share repurchases, despite the relative tax advantage of capital gains over ordinary income. The advantages of capital gains tax and other relevant matters regarding taxation and dividends are discussed in section 2.4.3 of this thesis.

Over the past twenty years share repurchase has experienced significant growth. Grullon and Michaely (2002) disclose the following relevant statistics, which are related to US firms:

- expenditures on share repurchase programmes by 2000 were 8.7 times the expenditures in 1980;
- share repurchase expenditures grew at an average annual rate of 26.1 per cent over the period 1980 to 2000, while dividends only grew at an average annual rate of 6.8 per cent; and
- share repurchases as a percentage of total dividends increased from 13.1 per cent in 1980 to 113.1 per cent in 2000.

Grullon and Michaely (2002) also reveal that, in 1999 and 2000, US corporations spent more money on shares repurchases than on dividend payments, and this was for the first time in history when share repurchases have been more popular than dividends.

The information given above has clearly answered the three questions given below that Grullon and Michaely (2002) wanted to answer when they conducted their study on US firms:

- question one: what are the reasons for this change in corporate payout policy?
- question two: are corporates buying back shares with funds that they would otherwise have used to pay divideds?
- question three: why did the process not start much earlier?

2.4 Which factors influence dividend policy?

The objective of this section is to identify the factors that influence the dividend policy decisions of a firm.

Dalton and Pointon (1997) confirm that numerous past research studies have identified the factors that influence corporate dividend policy decision, details of which are given below. There is no dominant factor that can be identified as establishing corporate dividend policy. Different factors tend to influence dividend policy decisions dominantly at different times.

Kania and Bacon (2005) confirmed that various factors, that are identified in dividend theory literature, work together to influence the dividend policy of companies. Some of the key factors that influence dividends are mentioned below.

2.4.1 Stability of dividends

In the UK, Rutterford, (1994) and Gill and Green (1993), and in the US Lintner (1956) have suggested that management tend to prefer stable dividends and avoid risking an increase in dividends, that may have to be reduced in the future.

Baker, Veit and Powell (2001) suggested that many managers of Nasdaq firms make dividend decisions consistent with Lintner's (1956) survey results and model. Baker, Veit and Powell's (2001) results also showed significant differences between the manager responses of financial and non-financial firms on nine of their 22 factors. This finding is implied to suggest that the presence of industry effects on dividend policy decisions causes the non-financial firms to have some different factors to financial firms. Additionally, the same factors that influence dividends in Nasdaq firms are generally also important to NYSE firms (see Baker, Veit and Powell; 2001).

2.4.2 Dividend payout ratio

Adedeji (1998) found a positive relationship between dividend payout ratios and debt financing in the UK. This was mainly because firms with larger proportions of debt financing are more financially risky, and so shareholders should demand a greater return on the shares, leading to a pressure to increase dividends.

2.4.3 Effects of taxation on dividend policy decisions

When the assumption made by Miller and Modigliani (1961) of a perfect tax free environment is relaxed, the dividend irrelevance proposition is questionable. The effects of taxation on dividend policy are mixed and the literature below regarding this issue is disjointed. More work is required to be carried out by researchers to enable us to see a clearer pattern of the effects on tax on dividend policy.

Most countries treat the taxation of dividends and capital gains differently. For example, in 1995 according to Price Waterhouse worldwide survey, long-term capital gains were exempt from taxation in Germany and in Japan only 55% of the long-term capital gains were taxable. In the UK and Australia the acquisition costs are index-linked so that only the real gains are taxable. In the UK and other countries even though capital gains are taxed at income tax rates, exemption levels tend to reduce the effective tax rates on chargeable gains. Some countries separate corporation tax from income tax under a classical tax system, whilst others allow for some of the corporation tax to be imputed (deemed paid) by the shareholders (see Table 2.4.3).

Table 2.4.3 A classification of tax systems

Classical tax systems	• USA • Japan
Imputation tax systems	• UK • Germany • France • Australia

It would seem beneficial for a US firm, for example, to retain profits within the corporation rather than to issue dividends, thus avoiding the double taxation under a classical system.

Dai (2007) showed that the results of the relationship between the dividend payout levels and investor's tax rates on dividends are mixed. Therefore different companies and investors respond to tax rates differently. Auerbach (1979), Miller and Scholes (1978), Feldstein and Green (1983) and Allen and Michaely (2002) all suggest that investors in high tax brackets still buy stocks that pay substantial amounts of dividends. By paying out dividends, Feldstein and Green (1983) observe that some US corporations are voluntarily inflicting a high tax liability on their shareholders.

Poterba (2004) investigates the influence of tax reforms on variation in dividend payouts over time. He finds in the US that dividend payouts are affected by the dividend tax rate, implying that corporate payout policy does respond to changes in tax regulations, consistent with the prediction of the tax clientele theory.

Dai (2007) has shown that firms pay out more dividends, when the relative tax rate on dividends goes down. He suggests that the tax effect is also associated with the firm's ownership structure, as the firm's dividend policy will only reflect changes in tax code, when tax brackets of its major owners have been affected (Dai, 2007).

Crossland, Dempsey and Moizer (1991) have supported the existence in the UK of tax-induced shareholder-clienteles, who for tax reasons avoid some shares, but are attracted to others. However, earlier Black (1976) argued that if any particular stockholder avoided stocks for tax reasons that certain investor would not be able to construct a well-diversified portfolio.

Nam, Wang and Zhang (2004) examined the effect of managerial stock holdings on corporate dividend payments under a new dividend tax environment. Utilizing a very rare event of the cut in dividend tax rates introduced in May 2003, Nam *et al* (2004) investigated whether managers holding sizable stakes direct their corporations to raise dividends for their own benefits. Nam *et al*'s (2004) results showed that managerial stock holdings have a significantly positive effect on both the likelihood and the extent of a dividend increase in the year 2003. However, their results suggested that there was no such relationship for the period of 1993 through to 2002 (the period before the dividend tax cuts).

Elton and Gruber (1970) , Poterba (2004) and Dai (2007), managed to demonstrate that dividends are relevant to the pricing of shares. Elton and Gruber's (1970) results suggested that tax rates decrease as the dividend yield (dividend per share / share price) ctreases and this had effect on the share price.

However on the other hand, in the UK Menyah (1993) did not find evidence to support the existence of a tax-induced dividend in affecting the pricing of shares, in his study of the ex-dividend pricing of shares from 1955 to 1984. Chui, Strong and Cadle (1992) discovered for 1955 to 1983 that, when certain companies which suffered from increased corporate tax exhaustion were excluded, the hypothesis that tax coefficients were the same across three different tax regimes was rejected. This finding suggests that in some situations the impact of certain tax systems has significant influences on share pricing.

With regards to taxation, Auerbach (1979) argues that retention is in effect a deferred dividend, and so the market should capitalise not only the retention but also the taxes payable on distribution. This means that to a 30% taxpayer, the retention of $1 is worth only 70 cents when it is paid in the future as a dividend. The $1 retention should be viewed by the investor as increasing the market value of the firm by only 70 cents. Auerbach (1979) refers to this reasoning as 'the capitalisation view', on the basis that the tax effects are capitalised in market prices. Auerbach 's (1979) 'capitalisation view', is regarded as consistent with the dividend irrelevance position.

2.4.4 Earnings' retention ratio

The study carried out by Adedeji (1998) on UK firms suggests that the earnings' retentions of a firm tend to be used to finance investments. Adedeji's (1998) suggestions seem to be consistent with the residual theory of dividends which states that dividends should only be paid when the firm has financed all its positive net present value projects. Therefore, if there are no worthwhile investments dividends are increased and low growth companies tend to pay high dividends, while high growth companies tend to pay low dividends. Thus, according to Adedeji (1998), dividend payout ratios are negatively associated with capital investment in the UK. Now, Myers' pecking order theory states that firms initially prefer to finance investment from retained funds, secondly if funds are inadequate, debt finance is considered and, finally, as a last resort external equity finance from the issue of shares is considered. Thus, Myers (1998)'s pecking order theory is consistent with the findings attained by Adedeji (1998).

2.4.5 Agency Costs

The agency cost is incurred by an organisation when there are problems such as:

- divergent management-shareholder objectives and
- information asymmetry between shareholders and other stakeholders of the firm.

In 1976, Jensen and Meckling carried out a study which showed that directors assure shareholders that they are managing corporate affairs in their best interest through dividend payments. The payments of cash are regarded as reducing the availability of cash for non-essential activities and hence reducing agency costs indirectly.

In their research study Jensen and Meckling (1976) integrated elements from the agency aspects of the theory of property rights and the theory of finance to develop their theory of the ownership structure of the firm. In their study Jensen and Meckling divided agency costs into three groups as follows:

- the monitoring costs by the principal,
- the economic bonding costs by the agent, and
- the residual economic loss.

Monitoring costs include audit fees, for example, and are necessarily incurred to monitor the behaviour of the managers, who should be making decisions on their behalf. Monitoring costs can be transferred to the agent by adjusting the remuneration package of the agent-manager (Godfrey et al, 1992). Economic bonding costs include accounts preparation, which are incurred by the company but the burden is passed on to the directors through remuneration adjustments (Godfrey et al, 1992). Nevertheless, the monitoring and economic bonding costs help determine a congruence of interests between principal and agent. Jensen and Meckling (1976) urgue that they are an unavoidable result of the agency relationship, and so the above two cost categories are not 'wasted', but deemed necessary. However, by contrast, residual economic loss refers to agent-managers' wasting money, which benefit the agent but not the principal, of which an example is expenditure on unnecessary perquisites. Residual economic loss therefore equals the total agency costs less the sum of the monitoring and economic bonding costs. Dividends reduce residual economic loss because there is less free cash flow, and hence less available to waste on self indulgent and reckless expenditure.

Jensen and Meckling (1976) also concluded that the level of agency costs depend among other things on statutory and common law and human creativity in devising better contracts. Both the law and the sophistication of contracts relevant to the modern corporations are the incentives by different company stakeholders to try and minimise agency costs.

Easterbrook (1984) suggested that firms that pay dividends at particularly favourable levels, that enable the firm to raise external finance, result in the management of the firm reducing its agency costs and transmitting new financial information to investors. Easterbrook (1984)'s suggestions are consistent with empirical evidence presented by Moh'd, Perry and Rimbey (1995). According to Rozeff (1982), firms that have lower dividend payout ratios have been found to have fewer insiders holding shares. Schooley and Barney (1994) found that, when the levels of shares that are owned by management are above 15 per cent, the dividend yield increases with ownership, hence higher dividend payments result. However, when the level of shares owned by management are less than 15 per cent, the dividend yield falls as ownership increases, hence a lower dividend payment. Dewenter and Warther (1998) concluded that for firms that omitted dividend payments the impact on the share price was much less for Japanese firms than for US corporations. They argued that the relationship-network between agents and investors in Japan was much closer and so Japan had lower agency costs.

2.4.6 Signalling

According to Miller and Modigliani (1961), in the world of uncertainly, there is a role for determining dividends as a signalling tool, conveying information from the directors of a company to its shareholders. Therefore deviations from established target payout ratios may be interpreted as a change in the future earnings anticipated by the management of the company. Also any other financial announcements, such as dividends declarations, inform investors and other stakeholders of the organisation about the future prospects of the firm. According to the signalling hypothesis, good management signals its management abilities by paying higher dividends than less able managers. Paying higher dividends sends a signal to the stakeholders that the company is in 'good hands'. However, Borokhovich et al's (2005) work shows that the signalling hypothesis has disappointing results when it is tested empirically. Borokhovich et al (2005) concluded that paying some, rather than no, dividends reduces agency costs, but find no evidence to suggest that a further increase in dividend payments reduces agency costs further. When dividends are paid out the lower agency costs imply that managers of the organisation will have less of their shareholders' cash to waste both in the current and future periods.

A study by Edwards, Mayer, Pasherdes and Poterba (1985) is consistent with the view that the adjustments in dividends signal the expected future earnings in UK firms. In the USA, Olson and McCann (1994) found that firms that followed a signalling dividend policy tended to have a higher growth of assets turnover but had lower growth of revenues. Olson and McCann (1994) found that the revenues of the signalling firms were most variable. The behaviour of the dividends' ability to signal future profitability was found by Asquith and Mullins (1983), in organisations that paid their first dividends or resumed dividend payments after a break of at least ten years, and excess returns were discovered in firms mentioned above.

Benartzi, Michaely and Thaler (1997) concluded in their study that firms that increase their dividends are less likely to find that their future earnings are reduced. Lintner (1956) seemed to imply from his interviews that earnings signal dividends and that partial adjustemts may be made in future years, earnings permitting. However, Davidson (2002) mentions that there is a widespread belief that a change in behaviour of dividends signals the future profitability the least when compared with a change in other variables.

As mentioned above one of the most important predictions of the dividend-signalling hypothesis is that dividend changes are positively correlated with future changes in profitability and earnings. Contrary to this prediction, Grullon, Michaely, Benartzi and Thaler (2005) show that, after controlling for the well documented non-linear patterns in the behaviour of earnings, dividend changes contain no information about future earnings' changes. Grullon, Michaely, Benartzi and Thaler (2005) show that dividend changes are negatively correlated with future changes in profitability (return on assets). Grullon, Michaely, Benartzi and Thaler (2005) investigated whether including dividend changes improves earnings' forecasts. They found that models that include dividend changes do not outperform those that do not include dividend changes.

2.4.7 Growth

Rutterford (1994) points out that generally managers believe that a steady growth trend in dividends is important for shareholders. However, Black and Scholes (1974) state that it is difficult to test whether expected returns, which comprise dividends and capital gains, are affected by dividend policy.

2.4.8 Financial risk

According to Chang and Rhee (1990), shareholders in more highly geared firms may demand higher dividends as a compensation for the level of financial risk. Additionally, Black (1976) confirms that increased dividends result in a reduction in funds available to creditors, which in extreme cases could affect credit terms of the company.

2.4.9 Takeovers

Dickerson, Gibson and Tsakalotos (1998) investigated the relationship between a company's dividend strategy and its risk of takeover. Their results from a large panel of UK quoted companies suggested that higher dividend payments are associated with a significantly lower conditional probability (hazard) of takeover. Dickerson, Gibson and Tsakalotos (1998) state that firms that wish to avoid takeover would be better to distribute the marginal unit of earnings in dividends rather than investing it in the company. They suggested that the presence of an active market for corporate control could encourage firms to raise dividends to maintain shareholder loyalty.

2.4.10 Capital investment needs

Bond and Meghir (1994) found that capital investment needs are likely to put restraints on dividends. They established that 'cheaper' internal funds are preferred in the financing of capital investments to borrowings and external shares. Bond and Meghir (1994) reached their conclusion after conducting a study on 626 large UK firms, from 1971 – 1986.

2.4.11 Transaction costs and issue costs

Dalton and Pointon (1997) mentions that capital markets are not frictionless, for when investors sell shares they can incur transaction costs. When firms reduce dividends and investors want to sell part of their holdings to rectify deficiencies in income (Miller and Modigliani, 1961), transaction costs are incured by investors. The transaction costs involved in selling the shares tend to limit such activities. However, transaction costs mentioned above are avoidable.

Buckland and Davis (1989) found that firms which pay dividends at high levels such that the firm ends up with insufficient retentions to meet capital investment requirements tend to seek external financing through the capital markets, although this is associated with issue costs. The issue costs incurred at the corporate level by the firm issuing shares are unavoidable when the firm is raising external finance.

Davidson (1986) conducted a study on dividend policy in imperfect markets particularly analysing the impact of transaction costs, taxation and issue costs on dividend policy. Davidson (1986) complies with Prisman's (1986) suggestions of considering the 'valuation operators' as being derived by the individual's position in the imperfect market (specifically, the individual's position in the lifecycle with exogenously determined personal tax rates). In his1986 study Davidson incorporated transaction costs and taxation into the simple lifecycle valuation model (the lifecycle model was adopted because the conventional valuation models of market equilibrium fail to incorporate market imperfections in a satisfactory manner). The imperfections point to investors' valuations as being a function of dividend policy, suggesting that certain dividend policies might lead to beneficial arbitrage opportunities. Although a given dividend policy cannot be value maximising for all investors, certain dividend polices tend to minimise the trading reaction on announcement. The equilibrium implications of dividend policies are argued as follows: each individual investor is assumed to have an optimum effective rate of return, which depends on a range of factors, such as the individual's wealth, tax rates, age etc.. For the purposes of Davidson's study it was assumed that only two factors affected an individual's optimum rate of return, which are tax rates and the individual's position in the lifecycle (captured by a simple saving-dissaving dichotomy). If there is a dividend level that leads to all individual investors valuing the firm identically, then this is termed in

Davidson's thesis (1986) a 'strong equilibrium dividend policy', which he acknowledges to be similar in definition to that of Prisman. A strong equilibrium dividend policy results in a non-abnormal trading activity both on announcements of dividends and afterwards. Davidson states that management regard strong equilibrium dividend policies as advantageous. On the other hand, if there is a dividend level that results in all individuals valuing their firms differently, this would be termed a 'weak equilibrium dividend policy'. The different valuations resulting under the 'weak equilibrium dividend policy' would be of a very small amount that is not sufficient to induce immediate trading because of transaction costs.

The following are the results that Davidson (1986) found when transactions costs were introduced in the lifecycle valuation model. The transactions costs were found to flatten the time path of the portfolio value, denoted w(t), and reduce lifetime transactions costs. Davidson also states that:

- for an individual who is divesting or disposing, the preference for dividends is high. The implication is that clienteles should go for high or low dividend paying stocks, with the maximum return to a saver and the opposite to a dis-saver; and
- the preferences of a third clientele holding some securities, which are in a non-changing phase (whose holders are neither investing or divesting) are likely to be a weak.
- The fourth group of clienteles consists of individuals, who are presently bound by the strong rationing constraint such that they do not currently hold shares. These clienteles would only be induced to move off this constraint in the short

term period if there was a possibility of an abnormally high return, for example, if there were a Trustee Savings Bank flotation.

When taxation under an imputation system (such as the one in the UK) is incorporated in the lifecycle valuation model together with transactions, similar results as those mentioned above were found. When taxation under a classical system (such as the tax system in the USA) is incorporated in the lifecycle model together with transaction costs, the following results are found:

- for a saving clientele to prefer dividends to retentions, the individual's average or marginal tax rates are less than capital gains tax rate less the transaction cost rate. For example, as given by Davidson (1986), if the effective capital gains tax rate is 20% and transaction cost rate is 4%, then the investor's marginal income tax or average tax rates should be less than 17% for high dividends to be preferred.
- for a dissaving clientele, dividends are preferred by investors, when the individual's average or marginal tax rates are less than the capital gains tax rate and the transaction cost rate. Considering the example above, dividends are preferred only if the investor's marginal rate is less than 23%. A dissaving tax-exempt institution would have a preference for dividends, only if the dividends were not reinvested. On the other hand, in the case of individuals a high level of transaction costs would be required to induce a preference for dividends over retentions.

2.4.12 Liquidity

Theobald (1978) suggests that excessive dividends in the UK could be a reflection of inflationary effects and the influence of historic cost profits. Consequently, Lawson and Stark (1981) suggested that in the UK dividend payments have been excessive in relation to cash flows. To counter-act this problem, as observed by Dalton and Pointon (1997), dividend cuts tend to reflect low liquidity. Later, Kania and Bacon (2005) have suggested not surprisingly that increasing dividends reduced liquidity.

2.4.13 Cultural effects

Stonehill and Stitzel (1969) and Collins and Sekely (1983) suggest that a significant determinant of the capital structure of firms with headquarters in different countries tends to be according to the particular country, in which the headquarters are located. Collins and Sekely (1988) conclude that one explanation for the above statement is that there tend to be different cultural factors that influence corporate capital structure.

The key to this was later unlocked by Coates, Davis, Reeves and Zafar (1995), Buckland (1989) and Van Ees and Garretsen (1994), who concluded that the countries that are identified as possessing a security based culture tend to be more sensitive to stock-market changes than those that tend to be bank oriented and this is one of the primary reasons for inter-country differences in dividend policy. They classified the UK, France and the USA as security based systems and Germany as a bank oriented system, whilst Japan was identified as possessing characteristics of both systems. Coates et al (1995) confirmed that, in Germany, banks play a significant role in the provision of debt to German firms. German banks have a tendency of having far closer relationships with corporate clients than those in UK and USA organisations. Consistent with this, Dalton and Pointon (1997) mention that since German firms have a propensity to improve liquidity by approaching their banks it would seem as if liquidity and gearing would not be critically important in determining corporate dividend policy in Germany. Also as far as the UK and Germany are concerned, Mayer (1994) points out that the UK firms' dividend policies tend to be non-flexible, but German firms regularly cut and waive dividends frequently. The cultural acceptance of this makes sense within the German environment, which has such a significant role played by the banking sector.

In contrast to the German case, Coates et al (1995) state that the UK, France and the USA all have strong and influential stock markets, and that the capital markets tend to be sensitive to changes in dividends. As dividends have a potential impact on share prices, this helps to explain the reluctance of UK and USA firms to cut dividends.

In the UK and the USA, firms are identified by Dalton and Pointon (1997) as having diverse ownership and relative autonomy of managers, resulting in the existence of asymmetric information between shareholders and management. The existence of asymmetric information leads to dividends being regarded as a signalling device, monitoring management performance of the organisation. Dalton and Pointon (1997) mention that it would seem as if, in the UK and the USA, signalling and growth have a tendency to be important factors that determine dividend policy, while liquidity and capital investment factors are likely to have less influence on dividend policy. The study by Dalton and Pointon (1997) gives results that are consistent with a number of researchers mentioned in section 2.4.6 of this thesis, particularly consistent with the study conducted by Edwards, Mayer, Pasherdes and Poterba (1985), which reflects the view that the adjustments in dividends signal the expected future earnings in UK firms. However, the signalling behaviour of dividends has been regarded in the relevant literature as giving very poor results particularly; Borokhovich et al's (2005) work discussed in section 2.4.6 of this thesis shows that the signalling hypothesis has disappointing results when it is tested empirically, exposing the weaknesses of the signalling hypothesis of dividends.

In Japan, Allen (1992) observed that Japanese companies tend to follow the practice of paying dividends at a constant percentage of par-value, which is usually 10%. It follows that he goes on to suggest that dividends do not act as a signalling device in Japan. By way of explanation, he points out that, in Japan, there exists a system of cross-shareholdings called 'mochiai', and this system results in close relationships existing between group companies. The close relationships between companies mean that direct information can easily flow between company management and some shareholders. Additionally, Allen (1992) states that a large proportion of external finance is provided by banks, whose funding tends to consist of short-term borrowing, because Japanese government security market regulations have restrictions on both the supply and demand of corporate debt. But what does determine dividends in Japan? Meric et al (2002) found that dividend policies in Japanese insurance firms and other financial organisations tend to be influenced by financial leverage, profitability and business risk indicators.

From Dalton and Pointon's study (1997) it would seem that the stability of dividends would be generally the common factor that influences dividend policy significantly in all the countries mentioned below:

- Australia
- France
- Germany

- Japan
- United Kingdom, and
- United States of America.

Dalton and Pointon (1997) suggested that the capital investment needs and liquidity needs of the organisation are of minimal importance in influencing dividend policies of European countries. However, the capital investment needs and liquidity needs of the organisation are in some cases very significant in influencing dividend policies in USA, Australia and Japan. Dalton and Pointon (1997) and Sekely and Collins (1988) call researchers to investigate the impact of different legal structures, cultures, and social differences in influencing divided policy in different countries.

According to Aivazian, Booth and Cleary (2003) most emerging markets have a bank centred financial system and contractual agreements are not normally at arm's length. Aivazian, Booth and Cleary (2003) suggest that firms in the emerging markets have more unstable dividend payments than their USA counterparts. The regression analysis results of the study conducted by Aivazian, Booth and Cleary (2003) on emerging markets' organisations indicate that dividends are much less sensitive to past dividends and these findings support the view that the capital markets in developing countries make dividends a less viable mechanism for signalling and for reducing agency costs than for their USA counterparts, operating in more highly developed arm's length capital markets.

Finally, Maury and Pajuste (2002) concluded that in Finland the control structure affects the dividend policy in Finnish listed organisations. In particular, when the chief executive officer is a large shareholder the firms tend to pay lower dividends. Maury and Pajuste (2002) suggested that dominant shareholders in control may plan generating private benefits associated with control, that are not shared with minority shareholders as indicated by lower divided payout levels.

2.5 Dividend policy guidelines for banks

Dickens, Casey and Newman (2002) compared the factors that influence dividend policy in industrial firms and US banking corporations. They proposed that the dividend discount model holds, i.e. a stock's price is affected by the value of its future dividends. Therefore, if dividends impact firm value, then the factors determining those dividends deserve investigation for particular companies and industries. Dickens, Casey and Newman (2002) also appreciated that in the past other researchers, such as Fama and French (1998), find empirical support for the relationship between share price and dividends. Dickens, Casey and Newman's (2002) work utilises the theory that states that dividends can signal management's view of a firm's financial condition (Bhattacharya, 1979 and Miller and Rock, 1985), although Borokhovich et al's (2005) work shows that the signalling hypothesis has generally disappointing results.

Past research, carried out by Barclay, Smith, and Watts (1995), utilised industrial firms, but excluded banking firms. But, Dickens et al (2002) adapted Barclay et al's (2005) study to make it suitable for banking firms. Dickens et al (2002) found that studying the dividend policy for banking corporations is interesting and important, given the banks' managerial differences relative to industrial firms as well as the banks' vital economic role, and from a practical standpoint many banks pay significant dividends.

Dickens et al (2002) produced two hypothesised dividend models, using firstly key variables chosen from the extensive dividend policy literature, and secondly adapting it for banks, namely:

Dividend Yield = f [Market-to-Book(-), Regulation Dummy(+), Log of Revenue(+), Future Earnings(+)] **(D C & N Model One)**

and

Dividend Yield = f[Market-to-Book(-), Capital-to-Assets(+), Log of Revenue(+), Future Earnings(+), Inside Ownership(-), Previous Dividend(+), Earnings Volatility(-)] **(D C & N Model Two)**

The mathematical signs in the equations show the expected relationship of each independent variable to dividend yield.

The following is the published literature particularly on agency theory that Dickens et al (2002) utilised in their research. Rozeff (1982) and Easterbrook (1984) both propose agency cost models for dividend determination which Dickens et al (2002) found useful. Rozeff (1982) does not examine industry differences, but does exclude three industries due to regulation (depository institutions, transportation, and insurance) and one industry (petroleum) because of its peculiar accounting procedures. Studies examining industry differences are consistent with Rozeff's (1982) model in general, but only for certain variables. Casey and Theis (1997) study the petroleum industry and find support for dividend policy to be related to agency problems and risk, but not investment opportunities or size. Barclay, Smith, and Watts (1995) and Noronha, Shome, and Morgan (1996) consider the agency model at a more general level by including an interaction term with the firm's capital structure. Chen and Steiner (1999) provide an example of the generalised model. Other researchers such as Moh'd, Perry, and Rimbey (1995) and Dempsey and Laber (1992) find support for the agency cost dividend model over time and across industry segments, and an industry relationship effect appears in Michel (1979), Dempsey, Laber, and Rozeff (1993), and Barclay, Smith, and Watts (1995). Casey and Dickens (2000) study banks and find support for investment opportunities and agency problems as determinants for dividend policy, but not risk or size.

Dickens et al's (2002) data sources were the Morningstar's Principia Pro July CDs for 1999 and 2000. Dickens et al (2002) identified from the July CDs firms by industry using Standard Industrial Classification (SIC) codes and eliminating those not incorporated in the U.S. and those firms with missing data.

Firstly in D C & N model one, Dickens et al (2002) screened the data to obtain 4,112 industrial firm observations over the three-year period to confirm the regression results of Barclay, Smith, and Watts (1995) who used a different data source and also who examined a different period. Dickens et al (2002) used Tobit regression, as did Barclay, Smith, and Watts (1995), to estimate the coefficients because 51 percent of the firms had a dividend yield of zero; a value of 25 percent justifies Tobit's usage.

Secondly in D C & N model two, Dickens et al (2002) identified and selected 677 banking firm observations for inspection within their adaptation of the Barclay, Smith, and Watts (1995) model. The model Barclay, Smith, and Watts (1995) used included investment opportunities, regulation, size, and signalling factors to explain industrial firms' dividend policy. Dickens et al (2002) initially accounted for agency conflicts. Dickens et al (2002) accepted that the theory holds that inside ownership reduces the agency problem, as Jensen and Meckling (1976) describe. Insiders have less need for dividends, as their ownership encourages efficient management. In addition, insiders also could receive compensation through perks and / or other non-dividend payment forms. On the other hand, a firm operated by managers without ownership interest may pay higher dividends for two reasons. Firstly, the managers may be encouraged to act together with owners' desires if feeling pressure to maintain and improve the dividend payout. Second, the non-owner managers can use dividends as a device to signal the firm's value (Bhattacharya, 1979; Miller and Rock, 1985). In keeping with Moh'd, Perry, and Rimbey (1995), Dickens et al's (2002) used the per cent of stock owned by employees or directors as their measure of the agency problem and denoted this measure as inside ownership. Based on the discussion above and the empirical results in Moh'd, Perry, and Rimbey (1995), Dickens et al (2002) expected inside ownership to have a negative relationship to dividend yield.

Dickens et al (2002) next added a variable to account for dividend history based on the classic Lintner (1956) and Fama and Babiak (1968) articles. Fama and Babiak reported that many firms simply opt for a stable dividend policy and base current dividends on the previous year's dividend. The measure they employed was the previous year's dividend per share divided by the previous year's stock price and they denoted it as the previous dividend. In keeping with Fama and Babiak's findings, they expected dividend yield to have a positive relationship to previous dividend. Finally, Dickens et al (2002) added a risk factor to the Barclay, Smith, and Watts (1995) model. Although Dickens et al's (2002) regulation variable, capital-to-assets, may capture some risk, they believed earnings volatility would improve their ability to identify risk. For support for this variable, they turned to Moh'd, Perry, and Rimbey (1995) who presented evidence that firms with unstable earnings pay fewer dividends. Dickens et al (2002) expected earnings volatility to have a negative relationship with dividend yield. Dickens et al (2002) used Ordinary Least Squares Regression in the estimation of the equation above because only eight per cent of the banking firms had zero dividend yields. This amount was well below the 25 per cent cutoff required to justify the Tobit estimation process.

Thus, Dickens et al (2002) found that for model one the results using the Tobit regression analysis for the 4,112 industrial firm observations from 1998-2000 data were consistent with the results found by Barclay, Smith, and Watts (1995), who also investigated industrial firms. Both studies on industrial firms found that dividend yield (dividend policy) was related to the firm's investment opportunities negatively, which was indicated by the market-to-book value, which had a negative relationship with dividend yield. Both results showed that regulated firms made regular dividend payments, which was shown by the positive association of a regulation dummy with dividend yields. Results revealed that higher revenue firms would have lower bankruptcy probability, and therefore would pay higher dividends. This was shown by the positive relationship of log of revenue and dividend yield. The signalling factor in Barclay, Smith, and Watts (1995) was abnormal earnings. The positive relationship between future earnings and dividend yield shows that a higher current dividend may signal greater expected future earnings. However, Borokhovich et al (2005), mentioned in section 2.4.6 of this thesis, state that the signalling hypothesis of dividend policy has disappointing results in signalling future earnings.

Dickens et al (2002) reported that their results for equation two above, which was applied to 677 banking firm-observations from 1998-2000, were similar to those for equation one, using Tobit output. The coefficients for the three variables:

- market-to-book (showing low investment opportunities being related to dividend policy),
- log of revenue (showing lower bankruptcy probability being related to dividend policy) , and

- future earnings (with higher current dividend signalling greater expected future earnings) ,

are consistent in sign and magnitude across both examinations. While the future earnings coefficient estimates are consistent, they are different from Moh'd, Perry, and Rimbey's (1995) results, who note that their findings seem to support the idea that firms with higher expected revenue growth tend to set lower dividends. This implied link between dividends and investment policies would mean lower dividends could be set to allow more internal financing (less external financing) of future growth opportunities. In general, the signs on all three variables support expectations that banking firms pay fewer dividends when more investment opportunities exist and pay more dividends the larger the firm. Thus, lower dividend yields seem to be signs of higher future earnings.

The results found by Dickens et al (2002) show that some of the factors that influence dividend policy in industrial firms also apply to banking corporations. This shows that the factors that influence dividend policies across different industries possess some significant similarities. Therefore the literature discussed in section 2.3 and section 2.4 of this thesis is relevant to banking corporations.

Overall, Dickens et al's (2002) study identifies seven factors believed to influence bank dividend policy, and found empirical support for five of them. The five empirically supported factors are investment opportunities, size, agency problems, dividend history, and risk. The findings suggested the following guidelines for bank dividend policy:

Guideline 0:

- This was developed because of the negative relationship between investment opportunities and dividend yield (dividend policy variable).

Guideline 1:

- This states that those banks with greater investment opportunities should conserve cash to fund those opportunities and, therefore, should pay fewer dividends. Dickens et al's (2002) results showed that banks with higher market – to – book values, and presumably greater investment opportunities, have lower dividend yields.

Guideline 2:

- This was developed because of the positive relationship between the size of the bank and its dividend yield.

Banks that are large in size are likely to pay higher dividends. Support for guideline 2 comes from the findings showing banks with higher total revenues pay higher dividend yields.

Guideline 3:

- This was developed because of the negative relationship between insider ownership and dividend yield.

Guideline 3 states that banks with fewer agency problems can pay smaller dividends. Empirical results supported this guideline by finding a higher percentage of insider ownership and corresponding fewer agency problems associated with lower dividend yields.

Guideline 4:

- This was developed because of the positive relationship between dividend history and dividend yield.

Guideline 4 states that banks should use their dividend history to set dividend policy. Dickens et al's (2002) results support this guideline by showing that the previous year's dividend yield influenced the next year's dividend yield.

Guideline 5:

- Finally, this guideline was developed because of the negative relationship between risk factors and dividend yield.

Guideline 5 states that banks that are subject to high risk should pay low dividends. Dickens et al's (2002) results showed a high coefficient of variation on earnings for the past five years (the high risk measure) being related to lower dividend yields.

Dickens et al's (2002) state that the five dividend policy guidelines mentioned above can be useful to bank managers, regulators and investors when considering bank dividend policy. They indicate that further work is necessary to explore the additional factors that will suggest added guidelines in setting an optimal dividend policy for banking firms. They also believe that a more inconsistent economic period may find regulation and risk factors impacting bank dividends.

2.6 Conclusion

The information contained in Chapter 2 confirms that a great deal of reseach has been carried out in the past regarding dividend policy. However, the literature shows that more research work on corporate dividend policy is still required, especially in the banking sector, which will enable researchers to work towards developing more unified theories on corporate dividend policy.

The following chapter will present the optmal control theory framework for dividend determination as proposed by Davidson (1980) and subsequent chapters will focus on the empirical work carried out by this study.

CHAPTER 3: PRESENTING THE OPTIMAL CONTROL THEORY MODEL

3.1 Introduction

The objective of Chapter 3 is to present the optimal control theory model for dividend determination as proposed by Davidson (1980). Section 3.2 briefly discusses propositions identified by Davidson (1980), relating to the control theory framework for dividend determination. Section 3.3 presents all the key formulae of the optimal control theory model for dividend determination as presented by Davidson (1980) and Section 3.4 concludes the chapter.

3.2 Discussion of the key issues regarding the optimal control theory framework

According to Davidson (1980), the optimal control theory framework for dividend determination endeavours to achieve the following two objectives:

1. To model indirectly the rational managerial behaviour rather than to model the valuation of the consumption stream of dividends paid out to shareholders. This is mainly because developing a dividend prediction model by analysing past dividends led to the Modigliani and Miller (1961) dividend irrelevance conclusion.
2. To analyse the change of dividend components occurring, across time, or across different periods of time (intertemporally).

Therefore, the optimal control theory framework simply explains the dividend changes across different periods based on rational managerial behaviour, rather than supposing to be a standard model that is assumed to optimise the share valuation in the firm. Critics could argue that the issue of uncertainty is not properly addressed, since the model does not take explicit account of uncertainty. Nevertheless, managers still need to make plans, and they could place more emphasis on the projected dividends in the near future.

The control theory framework for dividend determination presented in Section 3.3, utilises two key managerial based components of the objective function, which are:

1. a utility of dividends function namely $U(D(t))$, where $D(t)$ = dividends at time t, and
2. a utility function for terminal 'liquid assets', a pool of retained assets namely $W(A_T)$, where A_T = retentions at time T (the end of the control planning horizon period).

The managerial utility functions mentioned above are both from the family of concave utility functions as follows:

$U(D(t) = \log D(t)$, which has a concave down (increasing) shaped graph; and

$W(A_T) = b \log A_T$, which has a concave down (increasing) shaped graph.

The following are the assumptions made with regards to the optimal control theory model for divided determination:

1. the dividends are determined by a managerial policy function that takes into account the changes that occur across different periods of time (intertemporal managerial policy function).
2. The managerial policy function consists of the utility of dividends function, $U(D(t)$, and the weighting function for terminal 'liquid assets', $W(A_T)$.

3. The graphs for the managerial policy functions mentioned above are concave in shape. Therefore, both the utility from the dividends and retentions mentioned above are assumed to be gradually increasing over time, and at a certain particular level the utility of the increase in both dividends and retentions becomes insignificant.
4. The time element of the managerial policy function is weighted by a managerial time preference rate ρ (rho) estimated to be the cost of capital, ke, in this research study.
5. The retentions at time t are assumed to be reinvested by the firm at the rate of interest σ (sigma). Davidson (1980) states that to avoid the confusion with accounting concepts of retained profits and capital maintenance, the retentions, A(t), are assumed to be stocks of liquid assets (effectively, operating or current assets), which in certain circumstances may be negative. In this research study, working capital has been used as an estimate for liquid assets.
6. The income element, Y(t), is assumed to be exogenously determined. Specifically, the income before dividends reported in the organisation's profit and loss account has been treated as the income element for the control theory model in this study.
7. Davidson (1980) stated that observations conducted by Lintner (1965) had demonstrated that investment policy appeared to have little direct effect on dividend change, and, due to this, investment policy functions were not considered explicitly by the optimal control theory framework for dividend determination.

8. In the control theory framework managers can plan dividends intertemporally over a finite control planning horizon or can relax the planning horizon to an infinite horizon. The control planning horizons examined in this research study are finite periods. The control planning horizon is defined by this study as the time period that is considered in the planning process.
9. It is assumed that there is in operation a 'liquid assets flow' type of system, such as the one used by Walter (1957), under which the managerial policy functions mentioned above, U(D(t)) and W(A(t)), are applied. Therefore, identifying stocks of liquid assets (working capital, net current assets) is important.
10. The optimal control theory model assumes that there will be no external injection of capital into the organisation in the future.

Davidson (1980) suggested that a control planning horizon of T= 100 determines higher dividend levels than other smaller planning horizons, such as T=1 and T=6. In fact, the T=100 control planning horizon approximately the highest possible dividend levels (being to all intents and purposes an infinite time period). A firm following a T=100 trajectory (route) is identified as being in a potentially risky situation as to all intents and purposes no minimum values are placed on liquid asset levels and dividends relate only to earnings. The results of a control planning horizon of T= 100 are similar to those for an organisation which follows an infinite control planning horizon; it remains to be seen whether the results of this empirical research study supports any of the propositions suggested above.

In Davidson (1980), it is argued that the infinite horizon model, and hence also the T=100 horizon model, is not likely to be a good explanator of observed behaviour.

Davidson (1980), however, suggests that a more acceptable viewpoint is that dividends relate to 'long run' liquidity planned at a finite time horizon. Therefore the initial aim of this research study is:

- to examine the impact of different control planning horizons on projected dividends, and to evaluate how close these are to observed dividends realised in a modern USA banking environment. Further discussion of this is found in Chapters 5, 6 and 7.

The optimal control theory model for divided determination presented below in Section 3.3, possesses several capabilities as follows:

- an ability to determine dividend values over both the short–run and the long-run periods; actually, this research study only focuses on the dividends that are determined by the control model over the short-run periods, since such dividends will be compared with the empirical data, covering the period 2001 to 2005;
- an ability to determine dividends applying both finite and infinite control planning horizons; in this thesis the projected dividends are only determined after applying finite control planning horizons;
- an ability to determine both future dividend values and future liquid assets levels; and
- an ability to explain dividend changes between periods (therefore determining intertemporal changes of dividends).

3.3 The framework of the optimal control theory model for dividend determination as presented by Davidson (1980) [a step–by–step presentation]

In this subsection 3.3, Davidson's model is presented using his notation and procedures, as per his paper published in 1980. To enhance clarity the words and expressions used are frequently his.

The optimal control theory framework for dividend determination initially utilises the following two key managerial policy functions:

1. U (D (t)) = the dividend utility function, and
2. W (A(T)) = a utility function for terminal liquid assets [function for the stocks of liquid assets, A, at time T].

The problem in Davidson (1980) can be viewed as an investment versus consumption decision for managers. The liquid assets' position therefore determines the following:

1. technical solvency (liquidity state of the organisation) and
2. level of future dividends.

The utility policy functions given above are used by the dividend control model, which is presented below as equation (1). These functions are assumed to exhibit decreasing marginal utility, and belong to a family of concave utility functions as shown below:

1).The utility of dividends curve [this is given later as equation (8)]:

$U(D(t)) = \text{Log } D(t)$ ....when $\varepsilon=1$

and

$U(D(t)) = (1-\varepsilon)^{-1} D(t)^{(1-\varepsilon)}$ ....when $0 < \varepsilon <$ infinity (except unity).

2). The utility function for terminal asset [this is given later as equation (9)]:

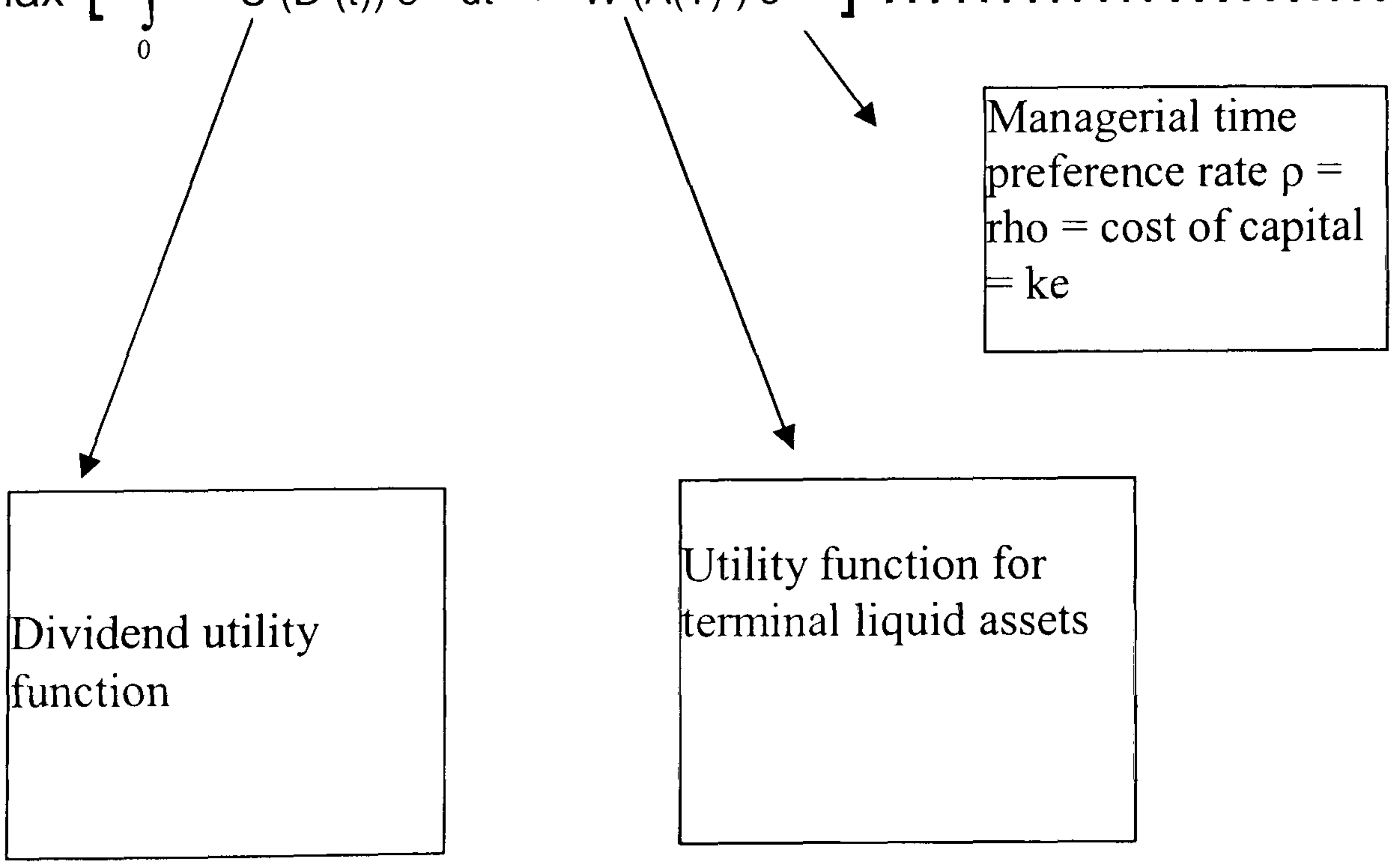
$W(A_T) = b\,(1 - \eta)^{-1} A_T^{(1-\eta)}$ ....when $0 < \eta <$ infinity (excpt unity)

but

$W(A_T) = b \log A_T$ ....when $\eta = 1$

The following is the presentation of the dividend control theory model for dividend determination. Assuming that there is no external injection of capital, the dividend control theory model is represented symbolically as:

$$\text{Max} \left[\int_0^T U(D(t))\, e^{-\rho t}\, dt + W(A(T))\, e^{-\rho T} \right] \qquad \text{(1)}$$



NB : The above model is subject to the following conditions :

$dA/dt = \sigma A(t) + Y(t) - D(t)$ .... equation of motion .... **(2)**

where Y(t) represents income at time t.

$A(0) = A_0$ .... initial asset position .... **(3)**

$D(t) \geq 0$ .... non-negativity of dividend .... **(4)**

$A(T) = A_T$ .... terminal liquid assets .... **(5)**

If the terminal asset position is not made explicit, as in equation (5), then it can be replaced by equation (6).

$U'(D(T)) = W'(A(T))$ .... transversality condition........................... **(6)**

The latter equation ensures that the marginal utility of dividends at time T is equated to the marginal utility of assets at time T.

Using the optimal control theory to find the path for dividends through time (t)

We need to know how the dividends evolve through time. Davidson uses the optimal path below:

$dD/dt = (\rho-\sigma)(U_D/U_{DD})$ .... **(7)**

To help arrive at the above optimal path, the problem can be viewed as a Hamiltonian. The derivation of the optimal path model using the Hamiltonian approach is given below.

Let : U(t) = U(c(t)) = utility function which is assumed to be increasing and concave in consumption (c). The object is to choose a consumption plan over a finite time horizon T which is optimal in the sense of maximizing the present value of the utility derived from this consumption, given the following:

- ρ = the discount factor being the rate of time preference,
- W = income earned per period as a continuous flow

- rk(t) = unearned income per period, where:-
  - r = rate of interest
  - k(t) = the value of the non-human wealth at time t.

It is assumed that it is a perfect capital market in which lending and borrowing takes place at a rate r, however there are some end-point constraints. At the beginning and at time T, zero nonhuman wealth is assumed. The problem thus takes the following form:

The object is to maximize:

$$\text{Max} \left[\int_0^T U(c(t),t)\, e^{-\rho t}\, dt \right]$$

subject to:

$$dk/dt = w + rk(t) - c(t)$$

$$k(0) = 0$$

$$k(T) = 0$$

The Hamiltonian for the above problem is:

$$H = U(c(t))e^{-\rho t} + y(t)\,[w + rk(t) - c(t)]$$

and the corresponding Hamiltonian conditions are

$$dH/dc = U'(c(t))\, e^{-\rho t} - y(t) = 0$$

$$dH/dk = ry(t) = -\dot{y}(t)$$

$$dH/dy = w + rk(t) - c(t) = \dot{k}$$

Solving the differential equation in dH/ dk, above we obtain,

$y(t) = y(0)\, e^{-rt}$

Substituting equation **y(t)** into **dH/dc** above we have after a little manipulation ,

$U'\ (c(t)) = y(0)\, e^{(\rho-r)\, t}$

Differentiating the U' **(c(t))** equation above with respect to time (t), we obtain,

$d\, U'\ (c(t)) / dt\ = (\rho\text{-}r)\ U'(c(t))$......this is the equation for the optimal consumption plan over a finite time horizon T.

Applying the above to our dividend problem to establish equation (7) the optimal dividend path can be found.

If $\partial / \partial x\ (dx/dt) + \partial\ / \partial y\ (\ dy/dt) = 0$

then, H(x,y) is a Hamiltonian.

In our problem, Hamiltonian (H) is a function H (D, A, y, t), and

$dA/dt\ = \sigma A(t) + Y(t) - D(t)$ [equation of motion : equation (2) above],

$\partial H / \partial y = dA/dt$ [the first maximum condition of Pontryagin],

$\partial H / \partial A = -\ dy/dt$ [second maximum condition of Pontryagin], and

$\partial H / \partial D = 0$ [a first order condition].

Now

$H = U(D(t))\, e^{-\rho t}\ + y(t)\ [Y + \sigma A - D]$

But

$dA/dt\ = \sigma A(t) + Y(t) - D(t)$, as above

and

$\partial H / \partial A = y(t)\, \sigma$

Therefore

$dA/dt = Y + \sigma A - D$

and $y(t)\sigma = - dy/dt$

$\sigma y = - dy/dt$

$\sigma dt = - (1/y)\, dy$

Therefore

$$\int_0^T \sigma dt = - \int_{y(0)}^{y(t)} 1/y dy$$

$\sigma t = -[\ln(y(t) - \ln y(0)]$

$\sigma t = \ln (y(0)/y(t))$

$e^{\sigma t} = y(0)/ y(t)$

Therefore : $y(t) = y(o)\, e^{-\sigma t}$

since H is a function $H(D,A,y,t)$

then

$\partial H/\partial D = \partial/\partial D\, (U(D(t))\, e^{-\rho t}) + \partial/\partial D(\, y(t)\, [Y + \sigma A-D)$

$= \partial/\partial U\, (U\, e^{-\rho t})dU/dD + \partial/\partial D(y(t)\, [Y+\sigma A-D])$

$=e^{-\rho t}\, U' + (-y(t))$.

At max utility, $\partial H/\partial D = 0$.

Therefore :

$e^{-\rho t}\, U' + (-y(t)) = 0$

Therefore :

$e^{-\rho t}\, U' = (y(t))$

Therefore :

$U' = e^{\rho t} (y(t))$

From earlier : $y(t) = y(0)\, e^{-\sigma t}$

Therefore :

$U' = y_o e^{(\rho-\sigma)t}$.

d/dD (U') = d/dD (dU/dD) = d/dD ($y_o e^{(\rho-\sigma)t}$)

= d/dt ($y_o e^{(\rho-\sigma)t}$) dt / dD .

$U_{DD} = (\rho-\sigma)\, y_o e^{(\rho-\sigma)t}$ dt/dD .

Therefore : dD/dt = [$(\rho-\sigma)\ y_o e^{(\rho-\sigma)t}$] / U_{DD}

But : $U' = U_D = y_o e^{(\rho-\sigma)t}$,as earlier.

Therefore ,

$dD/dt = (\rho-\sigma)\, U_D / U_{DD}$ ....**(7)**

(which is Davidson's (1980) equation (7)).

Equation dD / dt above is the rate of change in dividends over time, whose result is quoted by Davidson (1980) , citing Strotz (1956). In Davidson (1980), the need to apply Pontryagin's Maximum Principles explicitly to the maximized Hamiltonian is prevented although application of the Maximum Principle is implicitly applied.

The following section applies the utility policy functions to the optimal path for changes in dividends given by equation (7) above. When the utility policy functions (

equation 8 and equation 9) are applied accordingly to the dividend path (equation 7) the specific control model is determined.

Let equation (8) be:

1).The utility of dividends curve: ....**(8)**

$U(D(t)) = \text{Log } D(t)$ ....when $\varepsilon=1$

and

$U(D(t)) = (1-\varepsilon)^{-1} D(t)^{(1-\varepsilon)}$ ....when $0 < \varepsilon < 1$,

as discussed earlier, but repeated here for convenience.

Let equation (9) be:

2). The utility function for terminal asset...**(9)**

$W(A_T) = b\,(1-\eta)^{-1} A_T^{(1-\eta)}$ ....when $0 < \eta < 1$

and

$W(A_T) = b \log A_T$ ....when $\eta = 1$,

as discussed earlier, but repeated here for convenience.

In applying the transversality condition, it is necessary to define the utility function for terminal assets, which is presented in equation (9). Here, a scalar weighting 'b' is introduced as part of the utility function for terminal assets. It needs to be mentioned that A_T is derived and not predetermined.

Applying (7) to (8) to determine the dividend, D(t)

First of all, the rate of change in dividends over time is:

$dD / d(t) = [(\rho-\sigma) Y_0 e^{(\rho-\sigma)t}] / [d^2U / (dD)^2] = U_D (\rho-\sigma) / U_{DD}$.

From equation (8), let:

$U(D(t)) = \log(D(t))$.

Therefore

$dU / dD = U' = 1/ D(t) = D^{-1}$..........when $D(t) = D$

$dU'/ dD = d\,(dU/dD)/dD = dU_D / dD = (d^2U/dD^2) = U_{DD} = U'' = -1/D^2$

but from ....(7)

$dD / d(t) = (\rho-\sigma)\; U_D / U_{DD}$

But: $U = \log(D(t))$

Therefore:

$U_D = D^{-1}$

and

$U_{DD} = -D^{-2}$

Therefore:

$dD / d(t) = -(\rho-\sigma)\,(D^{-1}) / D^{-2} = -(\rho-\sigma)\,D$

Therefore, using separation by parts:

$dD / D = -(\rho-\sigma)\,dt$.

Therefore:

$$\int_{Do}^{D} (1/D)\,dD = -\int_{0}^{T} (\rho - \sigma)\,dt \,.$$

Therefore:

$\log(D) - \log(D_0) = -(p - \sigma)\,t$

$\log(D / D_0) = -(p - \sigma)\,t$.

Therefore :

$D / D_0 = e^{-(p - \sigma)t}$

Therefore, for $\varepsilon = 1$:

$D_{(t)} = D_{(0)} \exp[\sigma - \rho)/\varepsilon]t$ ....**(10)**

N.B. However, for a different utility function:

Let $U = (1-\varepsilon)^{-1} D(t)^{(1-\varepsilon)}$ .... for $0 < \varepsilon < 1$

$dU/dD = (1-\varepsilon)(1-\varepsilon)^{-1} D^{(1-\varepsilon-1)} = D^{-\varepsilon}$

$d^2U/(dD)^2 = -\varepsilon D^{(-\varepsilon-1)}$

Therefore :

$dD/dt = (U_D/U_{DD}) \cdot (\rho-\sigma) = [(D^{-\varepsilon}) / (-\varepsilon D^{-\varepsilon-1})] \cdot (\rho-\sigma)$

From ..(7)

$= -(\rho-\sigma) / \varepsilon D^{-1} = - D(\rho-\sigma) / \varepsilon$

Therefore :

$dD/dt = D(\sigma - \rho) / \varepsilon$ ....where $D = D(t)$

Therefore :

$$\int (dD/D) = \int (1/D)\, dD = \int [(\sigma - \rho)/\varepsilon]\, d(t)$$

Therefore:

$\ln (D / D_0) = (\sigma - \rho)\, t / \varepsilon$

Therefore:

$D_{(t)} = D_{(0)} \exp [\sigma - \rho)/\varepsilon]t$ ....**(10)**

b). <u>The Exogenous Income Y</u>

Now in (b) we consider Y income. Income is assumed to exhibit a geometric growth rate 'g'.

Therefore:

$Y_{(t)} = Y_0 e^{gt}$ ....**(11)**

Or

Change in $Y(t) = g\, Y_0 e^{gt} = gY(t)$ . ...**(11a)**

Considering the Transverality condition – (relating to the time at the end of the planning period 'T')

From equation (6) $U'(D(T)) = W'(A(T))$

Therefore at time 'T' :

$dU/dD = dW/dA$ which can also be written as $U_D = W_A = \pi(T)$

where $\pi(T)$ is the multiplier or shadow price at time T .

We now apply the transversality condition to equations (8) and (9).

From earlier,

$dU/dD = (1\text{-}\varepsilon)\,(1\text{-}\varepsilon)^{-1}\,D^{(1-\varepsilon-1)} = D^{-\varepsilon}$

and

the utility function $W(A_T) = b\,(1 - \eta)^{-1}\,A_T^{(1-\eta)}$

$dW/dA = W' = b\,(1 - \eta)^{-1}(1 - \eta)\;A_T^{(1-\eta-1)} = b\,A_T^{-\eta}$

Therefore at 'T'

$dU/dD = dW/dA = D^{-\varepsilon} = b\,A_T^{-\eta}$

$1/D^{\varepsilon} = b / A_T^{\eta}$

$A_T^{\eta} = b\,D^{\varepsilon}$.

Hence, liquid assets at time 'T' are :

$$\mathbf{A_T = (b\,D_T^{\varepsilon})^{1/\eta}} \quad \text{..}\mathbf{(12)}$$

In respect of the transversality, there is a tradeoff at the horizon date, in which terminal assets are a function of terminal dividends, including a scalar weighting, 'b'. The terminal dividends are derived, and hence not predetermined by the model.

Now we incorporate the utility functions stated in equations (8) and (9) into the original model equation numbered (1). After incorporating utility functions stated in equation (8) and (9), the expression becomes:

$$\text{Max}\left[\int_0^T (1-\varepsilon)^{-1} D^{(1-\varepsilon)} e^{-\rho t}\,dt + b(1-\eta)^{-1} A_T^{(1-\eta)} e^{-\rho T}\right] \text{.................................}(13)$$

Managerial time preference rate ρ = rho = cost of capital = ke

Dividend utility function

Utility function for terminal liquid assets (Member of general family of concave utility functions)

NB:- Where ($\varepsilon, \eta > 0$)

Equation (13) above is subject to the following conditions, as stated earlier, which include:

$dA/dt = \dot{A} = \sigma A + Y - D$....(14).... this is equivalent to the equation of motion, which is equation (2)

$A(0) = A_0$...............(15)...this represents the initial asset position, which is equation (3)

$D(T) = (A_T^{\eta} b^{-1})^{1/\varepsilon}$ ....(16)

NB: In this new model D (T) is not necessarily zero, but cannot be negative, in accordance with the non-negativity condition of constraint equation (4).

Simplifying the equations since both changes in D and A are now known:

Firstly, use the change in A to establish the equation for A(t) .

From equation (14), we note that:

Change in A = Y + σA –D

Multiplying the function by $e^{-\sigma t}$ gives

$\dot{A}\, e^{-\sigma t} = Y\, e^{-\sigma t} + \sigma A\, e^{-\sigma t} - D\, e^{-\sigma t}$

Therefore :

$\dot{A}\, e^{-\sigma t} - \sigma A\, e^{-\sigma t} = Y\, e^{-\sigma t} - D\, e^{-\sigma t}$

Rewriting the above equation gives

$d\,(A\, e^{-\sigma t})/dt = Y\, e^{-\sigma t} - D\, e^{-\sigma t}$.

Therefore integrating as an inverse function of a derivative

$$\left[A\, e^{-\sigma t}\right]_0^t = \int_0^t Y\, e^{-\sigma t}\, dt - \int_0^t D\, e^{-\sigma t}\, dt$$

$$A\, e^{-\sigma t} - A_0\, e^0 = \int_0^t Y\, e^{-\sigma t}\, dt - \int_0^t D\, e^{-\sigma t}\, dt$$

Multiply by $e^{\sigma t}$

$$A\, e^{-\sigma t}\, e^{\sigma t} - A_0\, e^0\, e^{\sigma t} = e^{\sigma t} \int_0^t Y\, e^{-\sigma t}\, dt - e^{\sigma t} \int_0^t D\, e^{-\sigma t}\, dt$$

Therefore :

$$A = A_0\, e^{\sigma t} + e^{\sigma t} \int_0^t Y\, e^{-\sigma t}\, dt - e^{\sigma t} \int_0^t D\, e^{-\sigma t}\, dt = A(t) \quad \text{..................}\mathbf{(17)}$$

But :

$Y = Y_0\, e^{gt}$ ....(11) and $D = D_0\, e^{(\sigma - \rho)t/\varepsilon}$ ....(10)

Substituting the above functions into equation (17) and integrating, gives:

$$A = A_0 e^{\sigma t} + e^{\sigma t} \int_0^t Y_0 e^{gt} e^{-\sigma t} dt - e^{\sigma t} \int_0^t D_0 e^{(\sigma - \rho)t/\varepsilon} e^{-\sigma t} dt = A(t)$$

$$A = A_0 e^{\sigma t} + e^{\sigma t} \int_0^t Y_0 e^{(g-\sigma)t} dt - e^{\sigma t} \int_0^t D_0 e^{[(\sigma - \rho)/(\varepsilon - \sigma)]t} dt = A(t)$$

$$A = A_0 e^{\sigma t} + e^{\sigma t} \Big[Y_0 e^{(g-\sigma)t} / (g-\sigma)\Big]_0^t - e^{\sigma t} \Big[D_0 e^{[(\sigma - \rho)/\varepsilon - \sigma]t} / [(\sigma - \rho)/(\varepsilon - \sigma)]\Big]_0^t$$

$$A(t) = A_0 e^{\sigma t} + e^{\sigma t} \Big[Y_0 e^{(g-\sigma)t} / (g-\sigma) - Y_0 / (g-\sigma) \Big] -$$

$$e^{\sigma t} \Big[D_0 e^{[(\sigma - \rho)/\varepsilon - \sigma)]t} / [(\sigma - \rho)/\varepsilon - \sigma)] - D_0 / [(\sigma - \rho)/(\varepsilon - \sigma)]\Big]$$

let :

$(g-\sigma) = j$ and $i = (\sigma - \rho)/\varepsilon$

Therefore A(t) then becomes:

$$A(t) = A_0 e^{\sigma t} + e^{\sigma t} \Big[(Y_0 e^{(j)t} / j) - Y_0 / (j) \Big] - e^{\sigma t} \Big[D_0 e^{[i-\sigma]t} / [(i-\sigma)] - D_0 / [(i-\sigma)]\Big]$$

From the above equation A(T) is then:

$$A(T) = e^{\sigma T} \Big[A_0 + (Y_0 / j) (e^{(j)T} - 1) - D_0 / (i-\sigma) (e^{[i-\sigma]T} - 1)\Big] \quad \text{.................}\mathbf{(18)}$$

Rearranging the above equation enable us to establish D_0

Therefore:

$$A(T) e^{-\sigma T} = e^{-\sigma T} e^{\sigma T} \Big[A_0 + (Y_0 / j) (e^{(j)T} - 1) - D_0 / (i-\sigma) (e^{[i-\sigma]T} - 1)\Big]$$

$$A(T) e^{-\sigma T} = e^{(-\sigma T + \sigma T)} \Big[A_0 + (Y_0 / j) (e^{(j)T} - 1) - D_0 / (i-\sigma) (e^{[i-\sigma]T} - 1)\Big]$$

Divide all functions by $(e^{[i-\sigma]T} - 1)$

$$A(T) e^{-\sigma T} / (e^{[i-\sigma]T} - 1) = 1/ (e^{[i-\sigma]T} - 1) \Big[A_0 + (Y_0 / j) (e^{(j)T} - 1) \Big] - D_0 / (i-\sigma)$$

Multiply all functions by..... $(i - \sigma)$

$$(A(T)\, e^{-\sigma T})((i-\sigma) \;/\; (e^{[i-\sigma]T} - 1) = (i-\sigma) / (e^{[i-\sigma]T} - 1) \left[A_0 + (Y_0 / j)(e^{(j)T} - 1)\right] - D_0$$

Therefore:

$$D_0 = (i-\sigma) / (e^{[i-\sigma]T} - 1) \left[[A_0 + (Y_0 / j)(e^{(j)T} - 1)] - (A(T)\, e^{-\sigma T})\right]$$

Therefore :

$$D_0 = (i-\sigma)(e^{[i-\sigma]T} - 1)^{-1} \left[A_0 - A(T)\, e^{-\sigma T} + (Y_0 / j)(e^{(j)T} - 1)]\right] \text{............} \mathbf{(19)}$$

From equation (18), which gives us A(T) we can establish the equation for A(t) :

Since :

$$A(T) = e^{\sigma T} \left[A_0 + (Y_0 / j)(e^{(j)T} - 1) - D_0 \;/\; (i-\sigma)(e^{[i-\sigma]T} - 1)\right] \text{...............} \mathbf{(18)}$$

Therefore A(t) is :

$$A(t) = e^{\sigma t} \left[A_0 + (Y_0 / j)(e^{(j)t} - 1) - D_0 \;/\; (i-\sigma)(e^{[i-\sigma]t} - 1)\right] \text{...............} \mathbf{(20)}$$

Since D_0 is given by (19), and A_T is given by equation (12), then the plan is to substitute for A_T in equation (19) and to rearrange.

$$A_T = (bD_T{}^{\varepsilon})^{1/\eta} \text{..} \mathbf{(12)}$$

$$D(t) = D_0 \exp\{[(\sigma-\rho)/\varepsilon]\, t\} \text{..} \mathbf{(10)}$$

Let :

$(\sigma-\rho)/\varepsilon = i$

Therefore:

$D_T = D_0 \exp(iT)$ and $A_T = (bD_T^{\varepsilon})^{1/\eta} = (b(D_0 \exp[(\sigma-\rho)T/\varepsilon])^{\varepsilon})^{1/\eta} = (b(D_0 e^{iT})^{\varepsilon})^{1/\eta}$ $= A_T$.

Substituting for A_T in equation (19) and rearranging gives:

$$D_0 = (i-\sigma)(e^{[i-\sigma)]T} - 1)^{-1} \left[A_0 - (b(D_0 e^{iT})^{\varepsilon})^{1/\eta} e^{-\sigma T} + (Y_0/j)(e^{(j)T} - 1)]\right]$$

Therefore rearranging gives:

$$D_0 + (b(D_0 e^{iT})^{\varepsilon})^{1/\eta} e^{-\sigma T} . (i-\sigma)(e^{[i-\sigma)]T} - 1)^{-1} =$$

$$(i-\sigma)(e^{[i-\sigma)]T} - 1)^{-1} . \left[A_0 + (Y_0/j)(e^{(j)T} - 1)\right] \quad \text{..........................}\textbf{(21)}$$

Equation (21) is very important since it enables us to find D_0 when A_0 and Y_0 are known.

Intertemporal Change of Dividend

{Change of dividend within periods (financial trading periods), are established by Davidson (1980) by adopting the simple partial adjustment and adaptive expectations empirical models, which perform well and which lead to reduced form equations which are similar from the viewpoint of conventional estimation. }

Along the dividend path through time, changes in dividends between financial periods can be evaluated.

The previous period will be denoted as **(τ – 1)** and the current period as simply τ. From equation (19), substitute D_0 for $D_{(\tau-1)}$.

$$D_0 = (i-\sigma)(e^{[i-\sigma)]T} - 1)^{-1} \left[A_0 - A(T) e^{-\sigma T} + (Y_0/j)(e^{(j)T} - 1)]\right] \quad \text{...........}\textbf{(19)}$$

Therefore equation (19) becomes:

$$D_{(\tau-1)} = (i-\sigma)(e^{[i-\sigma]T}-1)^{-1}\left[A_0^{(\tau-1)} - A_T^{(\tau-1)} e^{-\sigma T} + (Y_0/j)(e^{(j)T}-1)]\right]$$

Therefore also $D_\tau = (i-\sigma)(e^{[i-\sigma]T}-1)^{-1}\left[A_0^{(\tau)} - A_T^{(\tau)} e^{-\sigma T} + (Y_0/j)(e^{(j)T}-1)]\right]$.

Therefore change of dividend between periods is $D_\tau - D_{(\tau-1)}$.

Therefore:

$$D_\tau - D_{(\tau-1)} = (i-\sigma)(e^{[i-\sigma]T}-1)^{-1}\left[A_0^{(\tau)} - A_T^{(\tau)} e^{-\sigma T} + (Y_0/j)(e^{(j)T}-1)]\right] - (i-\sigma)(e^{[i-\sigma]T}-1)^{-1}\left[A_0^{(\tau-1)} - A_T^{(\tau-1)} e^{-\sigma T} + (Y_0/j)(e^{(j)T}-1)]\right]$$

Rearranging the above equation gives:

$$D_\tau - D_{(\tau-1)} = \left[(A_T^{(\tau)} - A_T^{(\tau-1)}) e^{-\sigma T} - (A_0^{(\tau)} - A_0^{(\tau-1)}) - (1/j)(Y_0^{\tau} - Y_0^{(\tau-1)})(e^{(j)T} - 1)\right] / \left[(i-\sigma)^{-1}(1 - e^{[i-\sigma]T})\right] \quad \text{.....(22)}$$

Now, assume the following:

$$Y_0^{(\tau-1)} = Y_0^{(\tau)} e^{-g}$$

and

$$A_0^{(\tau)} = A_{(1)}^{(\tau-1)}.$$

Therefore from equation (20), reprinted below:

$$A(t) = e^{\sigma t}\left[A_0 + (Y_0/j)(e^{(j)t}-1) - D_0 / (i-\sigma)(e^{[i-\sigma]t}-1)\right] \quad \text{.....(20)}$$

$A_{(1)}^{(\tau-1)}$ becomes:

$$A_{(1)}^{(\tau-1)} = e^{\sigma}\left[A_0^{(\tau-1)} + (Y_0^{(\tau)} e^{-g} / j)(e^{(j)}-1) - D_{\tau-1} / (i-\sigma)(e^{[i-\sigma]}-1)\right] \quad \text{.....(22 a)}$$

From earlier:

$$D_{(\tau-1)} = (i-\sigma)(e^{[i-\sigma]T}-1)^{-1}\left[A_0^{(\tau-1)} - A_T^{(\tau-1)} e^{-\sigma T} + (Y_0/j)(e^{(j)T}-1)]\right]$$

and $D_\tau = (i - \sigma)\,(e^{[i-\sigma]T} - 1)^{-1}\,\big[A_0^{(\tau)} - A_T^{(\tau)}\,e^{-\sigma T} + (Y_0/j)\,(e^{(j)T} - 1)]\,\big]$,

therefore, using equation (22a) :

$D_\tau - D_{(\tau-1)} =$

$$\Big[[(A_T^{(\tau)} - A_T^{(\tau-1)})\,e^{-\sigma T} + A_0^{(\tau-1)}\,(1-e^{\sigma})] + [(1/j)\,\{(e^{-j}-1) + (e^{-g}-1)\,(e^{jT}-1)\}]\,Y_0^{(\tau)} +$$

$$[e^{\sigma}\cdot(e^{[i-\sigma)} - 1)/(i-\sigma)]\;D_{(\tau-1)}\Big] \Big/ \Big[(i-\sigma)^{-1}\;(1 - e^{[i-\sigma]T})\Big]$$

The above equation is of the form:

$$D_\tau - D_{(\tau-1)} = a + b_1\,Y_\tau + b_2\,D_{(\tau-1)} \qquad \textbf{(23)}$$

Where :

$$a = (A_T^{(\tau-1)} - A_T^{(\tau)})\,e^{-\sigma T} + A_0^{(\tau-1)}\,(e^{\sigma}-1)\,]\;z \qquad \textbf{(24)}$$

$$b_1 = [1/(\sigma-g)\,\{(e^{(\sigma-g)}-1) + (e^{-g}-1)\,(e^{(g-\sigma)T}-1)\}\,]\;z \qquad \textbf{(25)}$$

$$b_2 = [\,[\varepsilon e^{\sigma}/(\rho+\sigma(\varepsilon-1))\,]\;.\;(e^{((\sigma-\rho)/\varepsilon-\sigma)}-1)\,]\;z \qquad \textbf{(26)}$$

and

$$z = \Big[(\sigma - (\sigma-\rho)/\varepsilon)\;\;(1 - e^{[(\sigma-\rho)/\varepsilon-\sigma)]T})^{-1}\Big] \qquad \textbf{(26b)}$$

To quote Davidson (1980), *'The values of b_1 and b_2 are found to be quite small, these terms capturing mainly interest and elasticity terms ; b_1 is the coefficient of the exogenous income Y(t) ; and a shows all items pertaining to liquid assets . The above equations determine future dividends for the organisation'.*

3.4 Conclusion

This chapter has confirmed that the optimal control theory for dividend determination presented by Davidson (1980) has several purposes and functions which are all relevant and important in enabling researchers to understand the dividend determination process. However, relevant empirical work is still required to enable researchers to exploit fully all the benefits that the control model has to offer. Some will be carried out in this thesis and suggestions about further empirical work that can be carried out in the future are identified in Chapter 8 of this thesis.

CHAPTER 4: SAMPLE DATA, VARIABLES AND RESEARCH METHODOLOGY

4.1 Introduction

This chapter is divided into two key parts. Part One (4.2 and 4.3) of this chapter introduces the sample data and variables that form the backbone of the statistical analysis in the thesis. Part Two (4.4 and 4.5) of this chapter presents the research hypotheses to be tested throughout the thesis. The methodology employed to test the hypotheses is also outlined in this second part of Chapter 4.

4.2 Part One – Data employed for the research

The data employed in this thesis are secondary data from Advanced Financial Network (ADVFN) on-line database. The secondary data provide a reliable and precise source of data for the research investigation.

4.2.1 The secondary data from ADVFN

The secondary data that are utilised for this study relate to banking corporations listed on the NYSE.

To validate the data gathered from ADVFN, some of the collected figures were compared to data published on DataStream database and both databases proved to contain similar financial figures.

The main advantage of using secondary data from ADVFN is that vast financial resources can be collected easily within a short period of time for free on-line. In addition the data from ADVFN are high quality accurate and relevant data required by this study. The key disadvantage is that the only complete free financial information available on ADVFN is NYSE financial information. Information for the other major stock markets in the world is very costly and not easy to access.

The primary users of ADVFN database are stock brokers and financial analysts. The ADVFN database can also be utilised by academics for their research due to the accuracy of information and extensive coverage of this database. ADVFN database provides data on most stock markets in the world at a cost and gives details of many financial accounts and economic items.

Retrieving data from ADVFN is very easy. All banking corporations that are listed on the NYSE are reported under financial group and banking sector. The banking sector is further divided into ten sub-sectors as follows:

- USA money centre banks,
- USA regional –Northeast banks,
- USA regional – Mid-Atlantic banks,
- USA regional – Southeast banks,
- USA regional – Midwest banks,
- USA regional – Southwest banks,
- USA regional – Pacific banks,
- Foreign Money Centre banks,
- Foreign regional banks and
- USA savings and loans banks.

The on-line ADVFN – Industry sector search enabled easy collection all the relevant data required for this study. The ADVFN database does not require program and code numbers to retrieve and display data on the database; it only requires the name of the corporation.

4.2.2 Description of data collected

Tables 4.1 and 4.3 show the two main groups of data gathered and constructed to constitute the data for this study.Table 4.1 below contains the first set of data collected, which consists of all the elements of the optimal control theory model. Obtaining all the relevant elements of the control theory model enables this research to investigate the effectiveness of the control theory in predicting future dividends for banks listed on the NYSE.

Table 4.1 The 12 key elements of the optimal control theory

	Symbol	Description	Notes
1	A_0	Liquid assets (working capital), at the beginning of planning period at time zero	See 4.2.2.1 below
2	Y_0	Income before dividends at beginning of planning period at time zero	Data collected from banks' profit and loss accounts statements
3	D_0	Determination of dividends at the beginning of planning period at time zero	**NO** data collected as this element is determined by the control theory model
4	A_t	Liquid assets (working capital), at the end of period t-1, (beginning of year t)	**NO** data collected as this element is determined by the control theory model
5	η	Eta	Equal to one (1) = unity * see note below
6	ε	Epsilon	Equal to one (1) = unity * see note below
7	b	Weighting factor b	See Section 5.2 for details
8	σ	Sigma	Return on retentions ≈ return on capital employed. Information is reported by ADVFN
9	ρ	Rho = Ke	Cost of capital - constructed here using CAPM, see Appendix 1
10	g	Growth rate of income	Growth rate of income = (Total current income *less* Previous income) / Previous income
11	T	The planning horizon date	The planning horizon date
12	t	A point in time $t \in [0, T]$	A point in time $t \in [0, T]$

***= Justification of why the elasticities have been assumed to be unity (see below):**

The simple logarithmic model has an 'Arrow-Pratt' Relative Risk Aversion (RRA) value of unity:

RRA = $-x \; U''(x) \; / \; U'(x)$, following Arrow (1971) and Pratt (1964).

Hence, when U(x) = log x,

RRA = $-x\,(-x^{-2}) \,/\, x^{-1} = 1$.

The elasticities contained in Table 4.1 above (η and ε) have been assumed to be unity.

Past reseach which has investigated the value of RRA has reported wide ranging values between 0.09 to 7.29. This suggests the following, that:

- the RRA is a difficult value to measure, or
- the RRA might not be constant at all, resulting in each one individual or groups of individuals possessing different RRA according to their different wealth levels. This is consistent with Morin and Suarez's (1983) findings, who used Canadian data to conduct their analysis.

The reseach conducted by Litzenberger and Ronn (1986) reported a RRA value of 4.22 based on a utility of consumption model of stock prices. Grossman and Schiller (1981) obtained an estimate value of 4.0. The results of both the above (1986) and (1981) research show RRA values significally different from unity. It is cited in Davidson (1986) that Friend and Blume (1975) and Blume and Friend (1975) used wealth data in their research and found a constant value of RRA ranging from 2.5 to 4. Lower values of RRA have been reported by Hansen and Signleton (1982), who used consumption data for their research study. Our selected value of unity for the elasticities above are with in the value range reported by Hansen and Singleton (1982) who used the more appropriate consumption data.

4.2.2.1 Constructing the substitute for working capital at the start of the planning period: A_0

Establishing the value of working capital of banking corporations is a challenge because the banks listed on the NYSE do not explicitly report it (in the traditional sense) nor provide financial information which enables a computation of it. Therefore to solve this problem this research has taken the following two steps to establish a substitute for working capital.

Firstly, what is the meaning of working capital? According to accounting literature by Atrill and McLaney (2004), working capital measures how much in liquid assets a company has available to build its business. In other words working capital indicates the organisation's assets which are free from risk (risk free assets). Analysts view working capital items as a sign of a company's efficiency, financial strength, success, expansion capacity and improvement opportunities. [4]

The results of a survey conducted by the consulting firm Hackett-REL, published in the Manufacturing Business Technology (2006) contributes that working capital is the capital invested in operating processes to generate profit and that the ability to impact the bottom line through working capital optimization is tremendous. Optimal capital adequacy for any business is vital.

The second step involves identifying the assets for a bank which are free from risk. The bank's risk free assets indicate the bank's efficiency, financial strength, success, expansion capacity and improvement opportunities.

4.2.2.2 Calculating a bank's Risk Free Assets (RFA)

Risk free assets are calculated in three phases:

Phase 1:- Requires the Basel I risk weights, (RW), for the balance sheet assets.

The Basel Committee, an international banking regulator, produced Basel I which is the international standard used by banks to measure the adequacy of a bank's capital. The Basel I Accord provides a step by step process which details the

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[4] Atrill, P. and McLaney, E. (2004), *Accounting and Finance for Non-specialists*, 4th Edition (2004), Published by Prentice Hall

determination of a bank's capital adequacy requirement. The Basel I agreement presents a list of the risk weights for balance sheet assets. The Basel committee and other published literature on banking regulation all supply a list of the necessary risk weights which are applied to the balance sheet assets to establish the risk weighted assets for a bank. [5] This study used the Basel committee website and other relevant published literature on banking regulations to pick-out all the relevant risk weights which are contained in Table 4.2. Appendix 5 contains some key aspects of the capital requirement regulation used to establish the relevant risk weights.

Phase 2:- Conversion of the gathered Risk Weights into Risk Free Weights (RFW)

In phase 1 above the Basel I risk weights collected are expressed as a percentage. This enables the researcher to convert the collected risk weights into risk free weights using the formula detailed below:

100 – risk weights (RW) = risk free weights (RFW) [i.e. 100 – RW = RFW].

Table 4.2 details the transformed Basel I Risk Weights into Risk Free Weights for relevant balance sheet assets applicable to banks listed on the NYSE.

Phase 3:- Determining the balance sheet risk free assets (RFA) for banks

To calculate the risk free assets for appropriate banks this thesis multiplies the monetary value of assets on the balance sheet by the appropriate risk free weight (RFW) given in Table 4.2. The product equals balance sheet risk free weighted assets for banking corporations.

[5] http://www.bis.org/publ/bcbsca.htm

Table 4.2 The table converting the Basel I Risk Weights into Risk Free Weights

Balance sheet assets	Risk Weights %	Risk Free Weights %
Cash and equivalent	0	100
Treasury bills	10	90
Other eligible bills	20	80
UK government stocks : • Loan stocks also known as Bonds • Gilt-edged securities / gilts	20	80
Commercial / personal loans	100	0
Mortgage loans	50	50
Premises , Fixed assets	100	0
Goodwill	0	0
Cash in the course of collection	20	80
Fixed interest securities issued by government of developed countries with residual maturity of **more** than one year	20	80
Fixed interest securities issued by government of developed countries with residual maturity of **less** than one year	10	90

Source of risk weights:

- MacDonald, S.S and Koch, T. W. (2006),
- Basel I capital accord Published by The Federal Reserve Board [6]
- Instruction for part 2 calculation of risk weighted assets, Published by Federal Deposit Insurance Corporation (Banking Review) [7]
- Basel Committee on Banking Supervision [8]

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[6] http://federalreserve.gov/generalinfo/base12/DraftNPR/NPR/Part_4.htm
[7] http://www.fdic.gov
[8] http://www.bis.org/publ/bcbsca.htm

4.3 Sample construction

A suitable sample of approximately 250 banks is constructed from a population of over 1000 banking corporations that are listed on the NYSE. The following three (3) stages are followed by this study to select the research sample:

Stage 1:- Identification of all banks listed on the NYSE

Banks listed on the NYSE as of August 2006 are classified into ten (10) different regional groupings. Ten (10) different Excel spreadsheets are used to record all banks according to the bank's appropriate regional grouping.

Stage 2:- Establishing the number of banks to be included in the research sample from each regional category. In this study, the ten different regional groupings mentioned above contain a varied number of banks. In accordance with Saunders el at (2006), where the regional groups had a smaller number of banks, the entire group is selected to constitute the research sample. Where the regional groupings contained a large number of banks, twenty-five (25) banks were randomly selected. Where regional groupings had smaller numbers, the whole group was selected.

Table 4.3 The size of regional groupings

	Names of the regional groupings for banks that are listed on the NYSE	Size of the regional grouping	Notes
1	USA Money centre banks	Small	Whole population selected to make up part of the research sample
2	USA regional – Northeast banks	Large	Sample is randomly selected
3	USA regional – Mid-Atlantic banks	Large	Sample is randomly selected
4	USA regional – Southeast banks	Large	Sample is randomly selected
5	USA regional – Midwest banks	Large	Sample is randomly selected
6	USA regional – Southwest banks	Large	Sample is randomly selected
7	USA regional – Pacific banks	Large	Sample is randomly selected
8	Foreign Money centre banks	Small	Whole population selected to make up part of the research sample
9	Foreign regional banks	Small	Whole population selected to make up part of the research sample
10	Savings and Loans	Large	Sample is randomly selected
Total			Approximately 250 banks selected [See Appendix 3 and Appendix 4 for some information on NYSE banks]

Stage 3:- The random selection of banks from the large regional groupings

All the banks identified in stage 1 are allocated a special random number, which is generated by the Excel random function: [=rand ()] .

All the generated random numbers for each bank are copied and pasted in the next column on the Excel spreadsheet without the formulae. This process freezes and holds the generated random number. The frozen random numbers are arranged in descending order by the Excel sort function.

The total number of banks selected from all regional groupings, which make up a total of about 250 banks, is the sample for this research study. The research hypotheses for this thesis are tested on approximately 250 banks that constitute the sample for this study.

4.4 Part two- Research Methodology – The estimation procedures of dividend levels through the use of the control theory model and details of the investgations undertaken to enable further insights into the control theory model

This research study utilised the control theory model to estimate dividend levels for NYSE banks. The following section 4.4.1 below details the procedures followed by this research to:

- estimate the dividend levels using the control theory model and
- to establish insights into the behaviour of dividends within the control theory model.

4.4.1 The research procedures applied in this study

The procedures followed by this study can be divided into three distinctive processes as follows:

- the initial process involved estimating the dividend levels,

- the subsequent process (the intermediate process) involved conducting relevant analysis to establish the characteristics of those NYSE banks, whose actual dividend patterns more closely matched those determined by the control theory model, and
- the final process identified the characteristics of NYSE banks that out-performed the optimal control theory model.

4.4.1.1 The initial research process – the basic control theory estimation procedures

The objective of this initial process was to investigate some fundamental arguments, put forward by Davidson (1980), which suggest that infinite horizon models, such as the T=100 horizon model, are not likely to be good explanators of observed dividend behaviour. Davidson (1980), however, suggests that a more acceptable viewpoint is that dividends relate to 'long run' liquidity planned at a finite time horizon.

It is therefore the initial hypothesis of this research study to test empirically the impact of distant control planning horizons and other different finite control time horizons and observe the dividend behaviour. The research question answered in this section of the study was therefore: *'Is the optimal control planning horizon for NYSE banks a finitely low horizon as suggested by Davidson (1980) or not?'*

The associated hypotheses that were tested by the initial processes included:

H_1 : low finite control planning horizons determine the level of dividends, of NYSE banking corporations.

Null Hypothesis 1

$H_{0(1)}$: low finite control planning horizons do not determine the level of dividends. Therefore high control planning horizons such as T= 100 will determine dividends.

The procedure to estimate the dividend levels for each bank at different planning horizons in this reseach began by studying and understanding the optimal control theory model in depth and breaking down the formulae of the model. The next stage involved designing suitable Microsoft -Excel spreadsheets and entering accordingly the formulae of the optimal control theory model on to Microsoft Excel spreadsheets. This work was followed by testing that the formulae entered on the Microsoft Excel spreadsheets worked efficiently and effectively in determining required dividends.

Formulae that were entered on the research's spreadsheets were tested using the examples published in the literature, as follows:

a) Complete verified published data previously presented in the literature were applied to these research spreadsheets.

b) The determined dividends produced by the research spreadsheets were compared with the published answers of predicted dividends.

c) When the research spreadsheets produced similar results to the published examples, the constructed spreadsheets were accepted as accurate. [The above mentioned procedure can be termed 'building excel spreadsheets containing control theory formulae phase'.]

After the spreadsheets that determine dividend levels were constracted, relevant data were required to be fed into the spreadsheets. This process involved identifying all the financial elements required by the optimal control theory model to determine future dividends and collecting the necessary data. The results of the determined dividend levels, that the research spreadsheets estimated, are fully discussed in Chapter 5 of this thesis.

4.4.1.2 The intermediate processes – identifying characteristics of NYSE banks, whose actual dividends closely matched those determined by the control theory model

The intermediate procedures follow on after having identified in Chapter 5 NYSE banks, whose actual dividends closely matched those determined by the control theory model. The objective of the intermediate processes is to identify the financial characteristics of the identified banks. Of course, some of the dividend policy factors for banks that other researchers have identified as significant might very well also be significantly associated with the control theory model. So, these will be tested.

The associated hypotheses that will be tested by the intermediate procedures include the following: -

Alternative hypothesis 2A

$H_{2\,A}$: NYSE banks with control-theoretic dividends are characterised by low investment.

Null Hypothesis 2A

$H_{0\,(2A)}$: NYSE banks with control-theoretic dividends are not characterised by low investment.

Alternative hypothesis 2B

$H_{2\,B}$: NYSE banks, with control-theoretic dividends are characterised by low risk.

Null Hypothesis 2B

$H_{0\,(2B)}$: NYSE banks, with control-theoretic dividends, are not characterised by low risk.

Alternative hypothesis 2C

$H_{2\,C}$: NYSE banks, with control-theoretic dividends are characterised by being a large bank in size.

Null Hypothesis 2C

$H_{0\,(2C)}$: NYSE banks, with control-theoretic dividends, are not characterised by being a large bank in size.

Alternative hypothesis 2D

$H_{2\,D}$: NYSE banks, with control-theoretic dividends are characterised by possessing a high dividend history.

Null Hypothesis 2D

$H_{0\,(2D)}$: NYSE banks, with control-theoretic dividends, are not characterised by possessing a high dividend history.

The procedures to establish the characteristics of the control-theoretic NYSE banks began by using relevant dividend policy literature contained in Chapter 2 of this thesis to identify the key constructs. The identified dividend policy constructs were translated into operational terms, typically ratios. All the variables mentioned above, and other additional appropriate variables were grouped to form the completed set of the independent variables as disclosed by Table 4-4 below.

Table 4.4 The list of independent variables collected for this study

Table 4-4	Variable	Formula
1	Debt Ratio	**Debt ratio = Total debt / Total assets**
2	Gearing Ratio	**Loan Capital / total capital employed**
3	Leverage Ratio	**Total debt / Shareholder's equity**
4	Dividend Yield	**Dividend policy (dividend yield) = dividend per share / share price**
5	Dividend Payout Ratio	**Dividend policy (payout ratio) = dividend paid / net income (profit)**
6	Return on Equity	**Net Income (One yr's earning)/ Shareholder's Equity**
7	Return on Assets	**Net Income (One yr's earning)/ Total Assets**
8	Return on Capital Invested	**Net Income (One yr's earning)/ Capital Invested**
9	Revenue Growth Rate	**Revenue growth rate = (Total current revenue now LESS previous revenue) /previous revenue**
10	Income Growth Rate	**Income growth rate = (Total current income now LESS previous income)/previous income**
11	Dividend Growth Rate	**Dividend growth rate = (Total dividend now LESS previous dividend)/previous dividend**
12	Percentage of the cash flow in the share price	**Liquidity indicator Percentage of the cash flow in the share price = (Cash flows per share/ share price) *(100) = [(Cash flow / number of shares)/(Share price)]*100**
13	Tobin's Q Ratio	**Total market value of the company (according to price traders) / Current cost of replacing firm's existing assets Or Value of stock market / corporate net worth**
14	Share price / Book value of assets	**Price / Book Ratio [Market to Book Value Ratio]**
15	Employee size	**Log of the number of employees**

The data for the independent variables ('X' variables), mentioned above in Table 4.4, were collected from the ADVFN database. Further descriptions of the variables are contained in Appendix 2. Firms that exhibit a control-theoretic dividend payment (see Chapter 6) are allocated a value of one for 'Y', and those that do not are given a value of zero. A logistic step-wise regression procedure is to be used to identify the factors that are associated whether the NYSE banks pay dividends that can be described as 'control-theoretic'. Further details of the work that was carried out in the intermediate stage and the results attained from the intermediate processes are given in Chapter 6 of this thesis.

4.4.1.3 The final set of procedures undertaken by this research to identify the characteristics of NYSE banks that out-perform the control theory model

The key objective of this final section of the study is to establish the characteristics of NYSE banks that out-perform the control model. Out-performers of the control model are the banks that pay higher actual dividends compared with the dividends determined by the control model. The fundamental research question that this section of the study answers is: *Which dividend policy factors are associated with out-performers of the control theory model?*

The detailed step by step procedures carried out in the final stage of this study are given in Chapter 7 of this thesis. Relevant to the dividend literature already discussed, the associated hypotheses that are tested in this section are detailed below.

Alternative hypothesis 3A

H_{3A}: Out-performers of the control theory model tend to be associated with low investment.

Null hypothesis 3A

$H_{0\ (3A)}$: Out-performers of the control theory model tend not to be associated with low investment.

Alternative hypothesis 3B

H_{3B}: Out-performers of the control theory model tend to be associated with low risk.

Null hypothesis 3B

$H_{0\ (3B)}$: Out-performers of the control theory model tend not to be associated with low risk.

Alternative hypothesis 3C

H_{3C}: Out-performers of the control theory model tend to be associated with the banks that are larger in size.

Null hypothesis 3C

$H_{0\ (3C)}$: Out-performers of the control theory model tend not to be associated with the banks that are larger in size.

Alternative hypothesis 3D

H_{3D}: Out-performers of the control theory model tend to be associated with the banks with a high dividend history. .

Null hypothesis 3D

$H_{0\ (3D)}$: Out-performers of the control theory model tend not to be associated with the banks that have a high dividend history.

Multiple regression and step wise regression analysis were applied to identify the characteristics associated with the out-performers of the control model. Details of the construction of the 'Y' variable are presented in Chapter 7, Section 7.3. Table 4.4 above identifies the 'X' variables that were used by the multiple regression and step wise regression analysis to identify the characteristics of NYSE banks that out-perform the control model. Further discussions regarding the procedures carried and results attained in the final stage are detailed in Chapter 7 of this thesis.

4.4.2 The results and conclusions of the research procedures

The results of the procedures that are carried out in this study were collected and reported accordingly in Chapters 5, 6 and 7. The conclusions of the research are established and presented in Chapter 8.

4.5. The test for multicollinearity in the independent variables

Prior to estimating the coefficients of the models, the sample data was tested for the existence of multicollinearity among the independent variables. Koop (2000) explains that multicollinearity exists when some or all of the explanatory variables are highly correlated with one another. Therefore, the regression model would have difficulty in explaining which explanatory variables are influencing the dependent variables.

Mendenhall and Sincich (1989) explain that, when serious multicollinearity is presented in regression analysis, it will increase the likelihood of rounding errors in the calculations of the estimates, and standard errors and hence the results reported may be misleading.

'Statgraphics' is used to produce the correlation matrix that shows the correlations among the different independent variables. After deriving the correlation matrix, the final set of independent variables is established, as indicated in Table 4.5 below. The strongly related independent variables are found to be between:

- Return on capital employed & sales to capital employed; the return on capital employed ratio is selected, as a more comprehensive measure,
- Gearing ratio & debt ratio, and also leverage ratio & debt ratio; in this study only one variable is removed here, namely the debt ratio,
- Return on assets is found to be related to the total assets turnover ratio; the return on assets ratio is kept, since dividend in theory should be more strongly linked to profitability.

The method suggested by Koop (2000) was used to eliminate related variables from the independent variable set. According to Koop (2000), to resolve the multicollinearity existence, at least one of the correlated variables should be selected and the other highly correlated variables should be removed from the regression. An alternative treatment which was not used in this study includes orthogonalisation, whereby two independent variables are separately regressed and one of which is removed but replaced by its residual in the original model. The Table 4.5 below shows the results of the correlation matrix for the independent variables that were finally accepted for this study.

Table 4.5 Results of the correlation matrix for the independent variables of this study

	Col 2 *debt*	Col 3 *gear*	Col 4 *lev*	Col 5 *div y*	Col 6 *payo*	Col 7 *RoE*	Col 8 *RoA*	Col 9 *RoCI*	Col 10 *rev g*	Col 11 *inc g*	Col 12 *div g*	Col 13 cash %	Col 14 *Tob Q*	Col 15 *mtbv*	Col 16 *log emp*
Col 2 ***debt***	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd	*vrrd
Col 3 ***gear***	*vrrd	**1**	-0.2 126	0.0 210	0.0 237	-0.1 484	0.0 880	0.3 722	0.0 121	0.0 931	0.1 304	0.0 152	0.2 018	-0.2 612	-0.0 171
Col 4 ***Lev***	*vrrd	-0.2 126	**1**	0.0 725	0.0 610	-0.1 329	0.1 115	0.1 341	0.0 162	-0.0 810	0.1 409	0.1 472	0.2 323	-0.2 042	-0.3 315
Col 5 ***div y***	*vrrd	0.0 210	0.0 725	**1**	-0.4 905	-0.0 198	0.2 405	0.1 184	0.2 056	0.0 169	-0.1 622	-0.0 702	0.0 701	-0.0 413	-0.1 150
Col 6 ***payo***	*vrrd	0.0 237	0.0 610	-0.4 905	**1**	0.0 039	-0.3 763	0.0 380	0.0 689	0.0 177	0.0 262	0.0 221	0.0 056	0.0 616	0.0 075
Col 7 ***RoE***	*vrrd	-0.1 484	-0.1 329	-0.0 198	0.0 039	**1**	-0.3 228	-0.4 198	-0.0 469	-0.1 318	-0.1 371	-0.0 994	0.1 087	-0.1 628	-0.2 652
Col 8 ***RoA***	*vrrd	0.0 880	0.1 115	0.2 405	-0.3 763	-0.3 228	**1**	0.0 324	-0.0 636	-0.0 426	-0.0 310	0.0 266	-0.0 291	-0.0 570	-0.0 097
Col 9 ***RoCI***	*vrrd	0.3 722	0.1 341	0.1 184	0.0 380	-0.4 198	0.0 324	**1**	-0.0 429	-0.0 460	-0.0 623	-0.0 061	0.2 329	-0.1 201	-0.0 221
Col 10 ***rev g***	*vrrd	0.0 121	0.0 162	0.2 056	0.0 689	-0.0 469	-0.0 636	-0.0 429	**1**	-0.1 379	-0.0 157	0.0 134	-0.0 439	0.0 015	-0.1 492
Col 11 ***inc g***	*vrrd	0.0 931	-0.0 810	0.0 169	0.0 177	-0.1 318	-0.0 426	-0.0 460	-0.1 379	**1**	-0.0 340	-0.1 146	-0.0 331	0.0 360	0.0 489
Col 12 ***div g***	*vrrd	0.1 304	0.1 409	-0.1 622	0.0 262	-0.1 371	-0.0 310	-0.0 623	-0.0 157	-0.0 340	**1**	-0.0 187	-0.0 842	-0.0 553	-0.1 074
Col 13 ***cash %***	*vrrd	0.0 152	0.1 472	-0.0 702	0.0 221	-0.0 994	0.0 266	-0.0 061	0.0 134	-0.1 146	-0.0 187	**1**	0.0 632	0.0 416	-0.0 789
Col 14 ***Tob Q***	*vrrd	0.2 018	0.2 323	0.0 701	0.0 056	0.1 087	-0.0 291	0.2 329	-0.1 439	-0.0 331	-0.0 842	0.0 632	**1**	-0.2 998	-0.0 214
Col 15 ***mtbv***	*vrrd	-0.2 612	-0.2 042	-0.0 413	0.0 616	-0.1 628	-0.0 570	-0.1 201	0.0 015	0.0 360	-0.0 553	0.0 416	-0.2 998	**1**	-0.0 869
Col 16 ***log emp***	*vrrd	-0.0 171	-0.3 315	-0.1 510	0.0 075	-0.2 652	-0.0 097	-0.0 221	-0.1 492	0.0 489	-0.1 074	-0.0 789	-0.0 214	-0.0 869	1

* vrrd = variable removed from research data

There are no correlations with absolute values greater than 0.5 amongst the above mentioned predictor variables.

Table 4.5 (b) The key for the above Table 4.5

	Columns on the correlation matrix	**Variable**
1	Col 2 - *debt* *variable removed from research data (*vrrd)	Debt ratio
2	Col 3 - *gear*	Gearing ratio
3	Col 4 - *lev*	Leverage ratio
4	Col 5 - *div y*	Dividend yield
5	Col 6 - *payo*	Dividend payout ratio
6	Col 7 - *RoE*	Return on equity
7	Col 8 - *RoA*	Return on assets
8	Col 9 - *RoCI*	Return on capital invested
9	Col 10 - *rev g*	Revenue growth rate
10	Col 11 - *inc g*	Income growth rate
11	Col 12 - *div g*	Dividend growth rate
12	Col 13 - *cash %*	% of cash flow in share price
13	Col 14 - *Tob Q*	Tobin's Q ratio
14	Col 15 - *mtbv*	Share price / book value of assets
15	Col 16 – *log emp*	Log of the number of employees

The absolute values of the correlations contained in Table 4.5 show that the independent variables that were selected for analysis by this study are sufficiently unrelated and appropriate.

4.5 Conclusion

Chapter 4 has discussed the data, variables, research questions, hypotheses and research procedures used in this study. Further relevant information and results will be discussed and presented as necessary in the subsequent Chapters 5, 6, 7 and 8.

CHAPTER 5: AN INVESTIGATION OF THE IMPACT OF THE CONTROL PLANNING HORIZONS ON DIVIDEND DETERMINATION

5.1 Introduction

The key objective of Chapter 5 is to investigate the impact of the control planning horizon, when determining dividends for US banking corporations. This chapter consists of the following sections: Section 5.2 specifies research procedures for the chapter; and Section 5.3 presents the results, which are discussed in Section 5.4 and to which the conclusions are presented in Section 5.5.

5.2 The research procedures undertaken

Chapter 5 of this thesis endeavours to investigate the impact of different control planning horizons when determining dividends for NYSE banking corporations. Therefore, the question being addressed in this section is: *what planning horizon would enable the control theory framework to generate planned dividends close to those observed in practice?* To answer the question, the following assumptions have been made for the initial phase of the study:

- the planning horizon (T) can include any number of periods. Therefore, T can be equal to 1 or T can be equal to 100, and so on.
- to determine the liquid assets (A_0) for the control theory model, this study assumes that working capital figures can be substituted for the liquid assets (A_0) figures. Section 4.2.2.1 of this thesis explains how the working capital figures for banking corporations are estimated in this study.

- the weighting factor (b), which is an important construct in the model is initially assumed to take a value close to one. This assumes a distribution of all liquid assets to shareholders at the terminal point in the optimal control model. Therefore, at the terminal point, the weighting factor (b) is initially assumed in this study to enter the time horizon transversality condition with a value of about b=1, which makes the dividend issued at T (i.e. D(T)) equal to the terminal asset value A(T). Assuming the factor (b) to take a value close to one is appropriate and sensible for this particular research because of the following two main reasons:

  - firstly, at the terminal point sharing out all distributable assets to s shareholders makes good economic sence particularly to the organisation's shareholders; and

  - secondly, even if the b-values are much different from one, it will be demonstrated that the resultant planned dividends are not statistically significantly different at the 95 per cent confidence level.

For this purpose, in order to obtain further relevant knowledge regarding the weighting factor (b) an analysis is conducted to compare the impact that different values of the factor 'b' would have on planned observed dividends. Five values of the weighting factor 'b' were identified and these included, 'b' = 1 'b' = 2, 'b' =3, 'b' = 10 and 'b' = other low value. To conduct the analysis the following procedures were carried out:

- each selected b-value was programmed into the optimal control theory model to determine future dividends for each bank.

-the five different sets of b-values successfully determined five sets of dividends.

- the five different sets of dividends that were determined were recorded accordingly and, using the Statgraphics plus version 5.1, analysed by a one way analysis of variance (ANOVA). The results of the one way analysis of variance are contained below in Table 5. They show that there is not a statistically significant difference between the dividends determined by the optimal control theory model for different b-values. So, the results confirm that the low b-values such as 'b' = 1, 2, 3, 10 or other low value, all tend to determine a similar dividend figure.

Table 5 – ANOVA tests, which confirm indifferences among the different b-values

The different statistics performed by the one-way analysis of variance	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Mean of determined dividends						
b=1	1164	1532	1912	2313	2755	3267
b=2	1154	1536	1927	2339	3815	3311
b=3	1138	1522	1916	2329	3807	3304
b=10	1092	1488	1891	2313	3782	3282
b= other low value	1172	1550	1941	2350	3826	3320
Standard Deviations of determined dividends						
b=1	2.201	2.462	3.001	1.210	1.576	2.079
b=2	2.176	2.442	2.985	1.205	2.300	2.074
b=3	2.158	2.428	2.975	1.203	2.299	2.073
b=10	2.071	2.358	2.924	1.192	2.294	2.068
b= other low value	2.196	2.458	2.997	1.208	2.301	2.076
ANOVA						
F – Ratio	0.00	0.00	0.00	0.00	0.10	0.00
P - Value	1.00	1.00	1.00	1.00	0.98	1.00
Multiple Range Tests (paired comparisons not significant)						
1 – 2	10.413	-4.417	-14.871	-21.395	-105.944	-43.852
1 – 3	26.402	9.025	-3.960	-16.449	-1.051.5	-36.437
1 – 10	72.671	43.887	20.598	-0.919	-102.641	-15.111
2 – 3	15.989	13.442	10.911	9.946	7.938	7.4152
2 – 10	62.259	48.305	35.470	25.475	33.029	28.741
3 – 10	46.270	34.863	24.559	15.529	25.092	21.326
0ther low value - 1	7.682	18.817	28.913	37.938	107.022	52.713
Other low value - 2	18.095	14.400	14.042	11.543	10.781	8.862
Other low value - 3	34.084	27.842	24.953	21.489	18.719	16.277
Other low value - 10	80.353	62.704	49.511	37.018	43.810	37.603
Cochran's C test						
P – Value	1.0	1.0	1.0	1.0	1.0	1.0
Kruskal – Wallis Test						
Test statistic	1.263	0.879	0.454	0.289	0.219	0.124
P – Value	0.868	0.928	0.978	0.991	0.994	0.998

Summary: Results in Table 5 show that there are no statistically significant differences between the dividends determined by different b-values.

After establishing the above assumptions, this study proceeds to complete the following four procedures detailed below, which enable this research to test the impact of the control planning horizon in determining dividends:

5.2.1 First stage – Building spreadsheets containing control theory formulae

At the first stage effective spreadsheets are designed that contain the control theory model formulae. The constructed spreadsheets determine the future dividends.

Section 4.4.1.1 of this thesis summarises the work that was carried out in this research study to construct the Microsoft Excel spreadsheets containing optimal control theory formulae, which determine projected dividends for this study.

5.2.2 Second stage – The number of spreadsheets constructed for each bank

For each bank selected for this study many sets of spreadsheets are constructed as necessary to determine dividends. Normally around five different Microsoft Excel spreadsheets were required to determine the control planning horizon of each bank.

The different Excel spreadsheets were constructed by applying, some of the following different planning horizons to the control theory model:

- T=1
- T=6
- T=18
- T=20
- T=50
- T=80
- T=100
- T=150

- T=200.

5.2.3 Third stage – Dividend determination phase (determining future dividends)

The control theory elements, mentioned in Chapter 4, were entered onto the spreadsheets mentioned above in 5.2.2.

When all the elements of the control theory are entered on to the constructed Excel spreadsheets, the control theory formulae contained within the spreadsheets are used to calculate the projected dividends for each bank.

5.2.4 Fourth stage – Identifying the ideal control planning horizon for each bank

The actual dividends paid out to shareholders were compared to the determined dividends for some of the following planning horizons:

- T=1
- T=6
- T=18
- T=20
- T=50
- T=80
- T=100
- T=150
- T=200

The difference between the actual dividends paid out to shareholders and the dividends determined by the control theory model produces a figure which this research study has called a dividend divergence figure [DDF].

Therefore:

determined dividend ***less*** actual dividend paid =

dividend divergence figure [DDF]

Secondly and finally: the dividend divergence figure [DDF] is expressed here as a percentage of the actual dividend and is then called the Dividend Divergence Rate. Therefore, the formula below calculates the **dividend divergence rate (DDR):**

(DDF / Actual dividends) x 100 = DDR

So, the dividend divergence rate [DDR] is the extent to which the determined dividends diverge from actual dividends paid.

5.2.5 Method used to establish results for this research

The following methods below have been applied to this research study to determine the results presented in Tables 5.1, 5.2 and 5.3.

5.2.5.1 Determining the ideal control planning horizon (T) for the control model

The control planning horizon (T), that produces the lowest dividend divergence rate (DDR) for each bank, is selected as the ideal control planning horizon for each bank. Table 5(a) below contains an example, detailing how the dividend divergence rate (DDR) is determined in this study.

5.2.5.2 Method used to establish the cut-off point which identifies the NYSE banks with control-theoretic dividends

The details explaining the method used by this research to establish the cut-off point, which identifies the NYSE banks with control-theoretic dividends is presented below.

Firstly: The average DDR (dividend divergence rate) for all the banks in the regional group is determined and then the standard deviation for the DDRs for all the banks in the regional group is established next. An example is contained in Table 5(b) below.

Secondly: Outliers were identified and eliminated from the cut-off calculations. To establish outliers in this study, the following example provides a clear explanation:

- The average values for DDRs was established as shown in Table 5(b): Average regional DDR = 111 %
- The standard deviation for the DDRs was also established as shown in Table 5(b) : High regional DDR Std Deviation = 163 %
- The value for two standard deviations was determined, as follows : 163 % + 163 % + 111 % = 437 %
- Any DDR from the USA Money centre banks which was above 437% was eliminated from the cut-off calculations.

Thirdly: A new average DDR is then calculated after eliminating all the outliers. In this example, the new average DDR is 105 %

Fourthly: The cut-off is identified for the control-theoretic dividends.

The DDR of 105 % is the cut-off point for the Money Centre banks. Any DDR for the Money Centre banks, which is below 105% (DDR<105%), is regarded as the value that identifies the banks with control-theoretic dividends.

Finally, any bank with a DDR > 105% is regarded in this study as not possessing control-theoretic dividends under the research assumptions stipulated in Section 5.2 above.

The procedures explained above, here in Section 5.2.5.2, for identifying banks with control-theoretic dividends were applied to all the other regional groups named in Table 4.3, and the results attained by this study for Chapter 5 are contained in Section 5.3 below.

5.3 Results

The initial results of this research contained in Tables 5.1 and 5.2 below answer the first research question of this study given above in Sections 4.4.1.1 and 5.2. The findings revealed in Table 5.1 show that there exists an ideal control planning horizon for NYSE banking corporations, which matches observed dividends.

Tables 5.1 and 5.2 indicate that higher control planning horizons tend to perform better. Table 5.2 shows that the popular ideal control planning horizon for all regional groups is T=100. By contrast, only a very small number of the banks showed that a low planning horizon determines observed dividends.

Table 5.3 below discloses whether a region contains a high proportion of banks whose dividend behaviour exhibits a control-theoretic pattern.

Table 5(a) Spreadsheet detailing how the dividend divergence rate (DDR) was determined -

Predicted Dividends	Monetary value US$	Monetary value US$	Monetary value US$	Monetary value US$	Monetary value US$
Control planning horizon (T)	**0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
T=6	3199.235305	3142.076673	3093.68	3068.84176	3066.122937
T=100	127.6054678	424.7360037	727.4544	1004.975906	1257.176428
Actual Dividends paid out to shareholders	**569**	**546**	**546**	**566**	**575**
Dividend Disparity or (Dividend Divergence) Figure [DDF]					
Predicted dividend less Actual dividend paid					
Control planning horizon (t)					
T=6	2630.235305	2596.076673	2547.68	2502.84176	2491.122937
T=100	-441.3945322	-121.2639963	181.4544	438.9759065	682.1764278
Dividend Disparity Rate [DDR]					
DDR = The determined dividends diverge from Actual or deviate (deflect) from Actual.					
[DDR = (DDF / Actual dividends) x 100]					
	0	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Control planning horizon (T)					
T=6	462.2557653	475.4719182	466.6081	442.1981908	433.2387716
DDR Optimum (T) T=100	**-77.6%**	**-22.2%**	**33.2%**	**77.6%**	**118.6%**

Table 5 (b) - Establishing the cut-off point for control theoretic banks – An example- Money Centre Banks

First step: Average DDR and Standard Deviation for USA - Money Centre Banks was established

Total value for DDR for all the banks in the regional group **[USA – Money Centre Bank]**	**5572.221286**
Average DDR - for all the banks in the regional group **[USA – Money Centre Bank]**	**111.4444257 %**
Standard Deviation - for all the banks in the regional group **[USA – Money Centre Bank]**	**163.6326873 %**

Table 5.1 Final results detailing the ideal planning horizon for each Regional Group

Notes:

* = Popular Planning Period (Overwhelmingly T=100 is the idea planning horizon for NYSE Banking corporation)

Regional Grouping	Planning Horizons For NYSE Banks 0<T<7	Planning Horizons 6<T<100	Planning Horizons T= 100	Planning Horizons Tt> 100
USA Money centre banks	0	0	*80%	20%
USA North East banks	3%	0	*67%	30%
USA Mid-Atlantic banks	0	0	*86%	14%
USA South East banks	13%	0	*60%	27%
USA Mid-West Banks	0	0	*65%	35%
USA South West Banks	12%	0	41%	*47%
Pacific Banks	15%	0	*75%	10%
Foreign Money Centre Banks	0	0	*92%	8%
Foreign Regional Banks	0	0	*100%	0
USA Savings & Loans Banks	0	0	*94%	6%
Average % for each Planning Horizon	4%	0	***76%**	20%

Table 5.2 Final results detailing regions' overall ideal control planning horizon for each group

Regional Grouping	Popularity rate above 60%	**Overall ideal control planning horizon for each regional group**
Money centre banks	√	T=100
North east banks	√	T=100
Mid-Atlantic banks	√	T=100
South-East banks	√	T=100
Mid-West banks	√	T=100
South West banks	√	T> 100
Pacific banks	√	T=100
Foreign money centre banks	√	T=100
Foreign regional banks	√	T=100
Savings and Loans banks	√	T=100
Common control planning horizon		T=100

Notes: √ = Yes

Regional Grouping	Regions containing a high proportion of banks with control-theoretic dividends	Regions containing a high proportion of banks without control-theoretic dividends
USA Money centre banks	√	
USA North East banks		X
USA Mid-Atlantic banks	√	
USA South East banks	√	
USA Mid-West Banks	√	
USA South West Banks	√	
USA Pacific Banks	√	
USA Foreign Money Centre Banks		X
USA Foreign Regional Banks		X
USA Savings & Loans Banks		X
Overall Results	**6/10**	**4/10**

Notes: √ = High number of banks with control-theoretic dividends in the region

X = High number of banks without control-theoretic dividends in the region

5.4 Discussion of Results

The following are some facts that summaries the key findings of chapter 5.

- With regards to the NYSE banks with control-theoretic dividends each bank had a unique control planning horizon which enabled the control theory framework to model observed dividends.

- T=100 is the most popular control planning horizon that enabled the control theory framework to model observed dividends.

- The higher control planning horizons tended to be most popular in modelling observed dividends.

- Some NYSE banks have control-theoretic dividends under the research assumptions, contained in Section 5.2 above.

- With regards to the NYSE banks with control-theoretic dividends very few banks had low unique control planning horizons which enabled the control theory framework to model observed dividends.

- Some NYSE banks do not have control-theoretic dividends under the research assumptions, contained in Section 5.2 above.

The results in Tables 5.1 and 5.2 suggest that a high control planning horizon possesses a greater chance of modelling observed dividends when applied to the optimal control theory framework within the reseach assumptions stated in section 5.2.

Applying a high control planning horizon, such as T=100, to the optimal control theory model seems to support the accounting going concern and continuity conventions that state that unless there is evidence to suggest otherwise, organisations should plan business decisions with the assumption that the entity will continue in business more or less indefinitely. Therefore, the results of Tables 5.1 and 5.2 mentioned above could also suggest that the optimal control theory model for dividend determination has a long term planning contingent / provision built within it. Literature on business management studies encourages long term planning [see, for example, Berry (2000) and Hankin, Seidner and Zietlow (1998)]. The optimal control theory model seems to cater for the long term provision well, which is good.

Results of this research study, contained in Table 5.3, suggest that some NYSE banks have control-theoretic dividends and other NYSE banks do not have control-theoretic dividend patterns.

In the next chapter, the focus will be upon the financial characteristics of those banking corporations classified by this study as having control-theoretic dividends.

5.5 Conclusion

Alternative control planning horizons were evaluated in terms of their impact upon the divergence between dividends determined by the control model and actual dividends. The optimal planning horizon was then determined (see section 5.2.5). There was a preponderance of very long optimal planning horizons. Outlier divergences were eliminated. Most of the foreign banks typically did not have control-theoretic dividends. In Chapter 6 the focus will be upon determining the factors that are associated with the banks that have control-theoretic dividends.

CHAPTER 6: IDENTIFYING THE FACTORS THAT GOVERN NYSE BANKS WITH CONTROL- THEORETIC DIVIDENDS

6.1 Introduction

The key objective of this chapter is to identify the factors that govern NYSE banks with control-theoretic dividends. This chapter consists of the following: Section 6.2 specifies the procedures used in this thesis to achieve the objectives of the chapter. Section 6.3 presents the results of the chapter. The results of this chapter are discussed in Section 6.4 and finally conclusions are given in Section 6.5.

6.2 The procedures undertaken to identify the characteristics of NYSE banks with control-theoretic dividends

Having identified in Chapter 5 above the NYSE banks with control-theoretic dividends, this chapter endeavours to establish the key factors that are associated with such banks.

Past research has successfully identified some factors that influence dividend policy in organisations, and these factors are used here to test hypothesised characteristics of the banks with control-theoretic dividends. Section 4.4.1.2 above has clearly stated the key hypotheses being tested and the research question being answered here in Chapter 6.

The following procedures were undertaken by this investigative research to identify the factors that govern the banks with control-theoratic dividends:

Stages 1 and 2 involved the collection of two types of relevant information for all the banks in the research sample. In Stage 1, the first type of information that was collected for each bank was the dependent variable (Y variable) for each bank. The dependent variable was the dividend divergence rate as explained below.

The method used to create the Y variable for this study

Initially, the actual dividends paid out to shareholders were compared with the control-theoretic dividends using various control planning horizons:

- T=1
- T=6
- T=18
- T=20
- T=50
- T=80
- T=100
- T=150
- T=200

The difference between the actual dividends paid out to shareholders and the dividends determined by the control theory model produces a figure which in this thesis is called a Dividend Divergence Figure [DDF].

Therefore:

Determined dividend ***less*** Actual dividend paid = **Dividend Divergence Figure [DDF]**

Secondly and finally: the dividend divergence figure [DDF] is expressed as a percentage of the actual dividend and is then called the Dividend Divergence Rate.

Therefore the formula below calculates the **dividend divergence rate (DDR) as:**

(DDF / Actual dividends) x 100 = DDR

Stage 2:

The second set of information collected for each bank included the independent variables, as listed in Table 4.4.

Stages 3:

The collected information for all the relevant banks was entered onto a single spreadsheet to make up a single group.

Stage 4:

The information contained on the above mentioned spreadsheet was divided into two distinct groups.

The first group was made up of the banks that have control-theoretic dividends and such banks make up the statistics reported in Table 5.3 above. By contrast, the second group only contained the banks that were identified in Chapter 5 above as not having control-theoretic dividends.

Stage 5:

For the dependent variable (Y variable) of the first group of data the binary value 1 was used.The dependent variable for the second set of data was number 0.

Stage 6:

The above mentioned two groups containing the ones and zeros were merged back to form one group again.

Stage 7:

The above mentioned single group was copied and pasted onto a file from a computer package called Statgraphics plus version 5.1. The logistic regression analysis and logistic stepwise regression analysis were applied to identify the factors that govern the banks with control-theoratic dividends.

6.3 Results

As indicated by the low likelihood ratio p-values, Tables 6.1 and 6.2 identify the following as factors that typify the banks with control-theoretic dividends:

- high dividend yield
- high leverage
- high return on capital invested

- high Tobin's Q ratio.

Possessing a small number of employees is identified by Table 6.1 as being another key factor that is associated with banks that have control-theoretic dividend patterns. Each of these factors is significant at the 99 per sent confidence level. Table 6.2 reveals that certain regional groupings greatly influence the characteristics of banks with control-theoretic dividends. In particular, certain groupings are peculiar. So, the affiliation into:

- the foreign banks listed on the NYSE,
- the USA Mid-Atlantic, and
- the USA Pacific regional banks

have a critical influence on identifying the characteristics of banks with control-theoretic dividends. The foreign banks and the Mid-Atlantic banks do not in general have control-theoretic dividends. However, the Pacific regional banks tend to possess control-theoretic dividends.

The logistic regression analysis produced the following equation:

$$\log [p / (1-p)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon$$

(An example can be found in Hutcheson and Sofroniou (1999))

where p = probability of 'success' (i.e. control-theoretic)

$1-p$ = probability of 'failure' (i.e. not control-theoretic)

$\beta_0, \beta_1, \ldots, \beta_n$ = coefficients

$X_1, X_2, \ldots, X_n$ = independent variables

ε = error term.

The logistic regression analysis in this study produced the following equation:

ln {*p*/ (1-*p*)} = -1.01154 + 0.0219257*Col _4 + 0.261964*Col _5 + 0.200033*Col _9 + 3.66953*Col _14 + 0.295728*Col _16

which can be re-written as:

ln {*p*/ (1-*p*)} = -1.01154 + 0.0219257*Leverage ratio + 0.261964*Dividend yield + 0.200033*Return on capital invested + 3.66953*Tobin's Q ratio + 0.295728* Log of number of employees.

It follows that the probability of a bank to exhibit a control-theoretic dividend pattern is related to the independent variables as follows:

$$p = \frac{\exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n)}{1 + \exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n)}$$

The above mentioned equation identifies banking corporations that possess the capability of applying the control theory model for dividend determination.

Table 6.3 displays that a cut off point of 0.5 maximises the total percentage of correct predictions.

Final Step-wise Logistic Regression for the whole sample of banking corporations listed on the NYSE

Results: Without regional dummies (factors that govern banks with control-theoretic dividends)

Parameter	Estimate	Likelihood ratio test: Chi-Square	Likelihood ratio: P-Value	Other statistic
Constant	-1.011	-	-	-
Leverage Ratio	0.022	9.25	0.0024***	-
Dividend yield	0.262	16.15	0.0001***	-
Return on Capital Invested	0.200	97.32	0.0000***	-
Tobin's Q Ratio	3.670	15.57	0.0001***	-
Log of the number of employees	-0.296	8.456	0.0036***	
Percentage (%) of deviance explained by model	-	-	-	14.179%
Adjusted percentage (%)	-	-	-	12.79%
Chi-square goodness of fit test –:Chi-squared	-	-	-	4.252
Chi-square goodness of fit test –: P-value	-	-	-	0.119

Notes: *** = significant at 99% confidence level

The conclusion for Table 6.1:

Since the chi-square goodness of fit test has a P-value of 0.119 > 0.05, there is no reason to reject the adequacy of the fitted model at the 95% confidence level.

Final step-wise logistic regression analysis for the whole sample, banking corporations listed on the (NYSE)

Results : With regional dummies (factors that govern banks with control-theoretic dividends)

Parameter	Estimate	Likelihood ratio test: Chi-Square	Likelihood ratio: P-Value	Other statistic
Constant	-1.686	-	-	-
Leverage Ratio	0.040	17.41	0.0000***	-
Dividend yield	0.292	19.12	0.0000***	-
Return on Capital Invested	0.192	84.47	0.0000***	-
Tobin's Q Ratio	3.423	11.65	0.0006***	-
Mid-Atlantic Banks	-0.639	4.53	0.0332**	-
Pacific Regional Banks	0.917	4.77	0.0290**	-
Foreign Money Centre Banks	-1.55	18.96	0.0000***	-
Foreign Regional Banks Regional Banks	-2.008	27.83	0.0000***	-
Percentage (%) of deviance explained by model	-	-	-	18.62%
Adjusted percentage (%)	-	-	-	16.54%
Chi-square goodness of fit test – :Chi-squared	-	-	-	3.500
Chi-square goodness of fit test –: P-value	-	-	-	0.174

Notes: *** = significant at 99% confidence level; ** = significant at 95% confidence level

The conclusion for Table 6.2:

Since Chi-square goodness of fit test, P-value is 0.174 > 0.05, there is no reason to reject the adequacy of the fitted model at 95% confidence level.

Regression for the whole sample (Banking Corporations listed on NYSE)

Results: without regional dummies

Cut-off	True	False	Total
0.0	100.00	0.00	69.23
0.05	99.37	3.77	69.96
0.1	98.95	4.72	69.96
0.25	98.32	16.04	73.00
0.3	97.06	20.28	73.44
3.5	97.06	28.30	75.91
0.4	94.55	29.72	74.60
0.45	93.50	38.21	76.49
☼ **0.5**	☼**90.99**	☼**50.94**	☼**78.23**
0.55	87.42	57.55	78.23
0.6	84.28	61.79	77.36
0.65	79.87	68.87	76.49
0.7	71.91	73.11	72.28
0.75	64.36	83.96	70.39
0.8	57.44	87.74	66.76
0.85	45.70	93.40	60.38
0.9	29.56	97.64	50.51
0.95	13.84	98.58	39.91
1.0	0.00	100.00	30.77

Notes:

☼ = Cut-off that maximises the total percentage of correct predictions

'True' = Percentage of all true responses that were correctly predicted

'False' = Percentage of all false responses that were correctly predicted

The 0.5 cut-off maximises the total percentage of correct predictions, and is therefore the preferred choice for predicting addition data items.

The prediction equation is

$\ln \{p/(1-p)\} = -1.01154 + 0.0219257*\text{Leverage ratio} + 0.261964*\text{Dividend yield} + 0.200033*\text{Return on capital invested} + 3.66953*\text{Tobin's Q ratio} + 0.295728*\text{Log of number of employees}$.

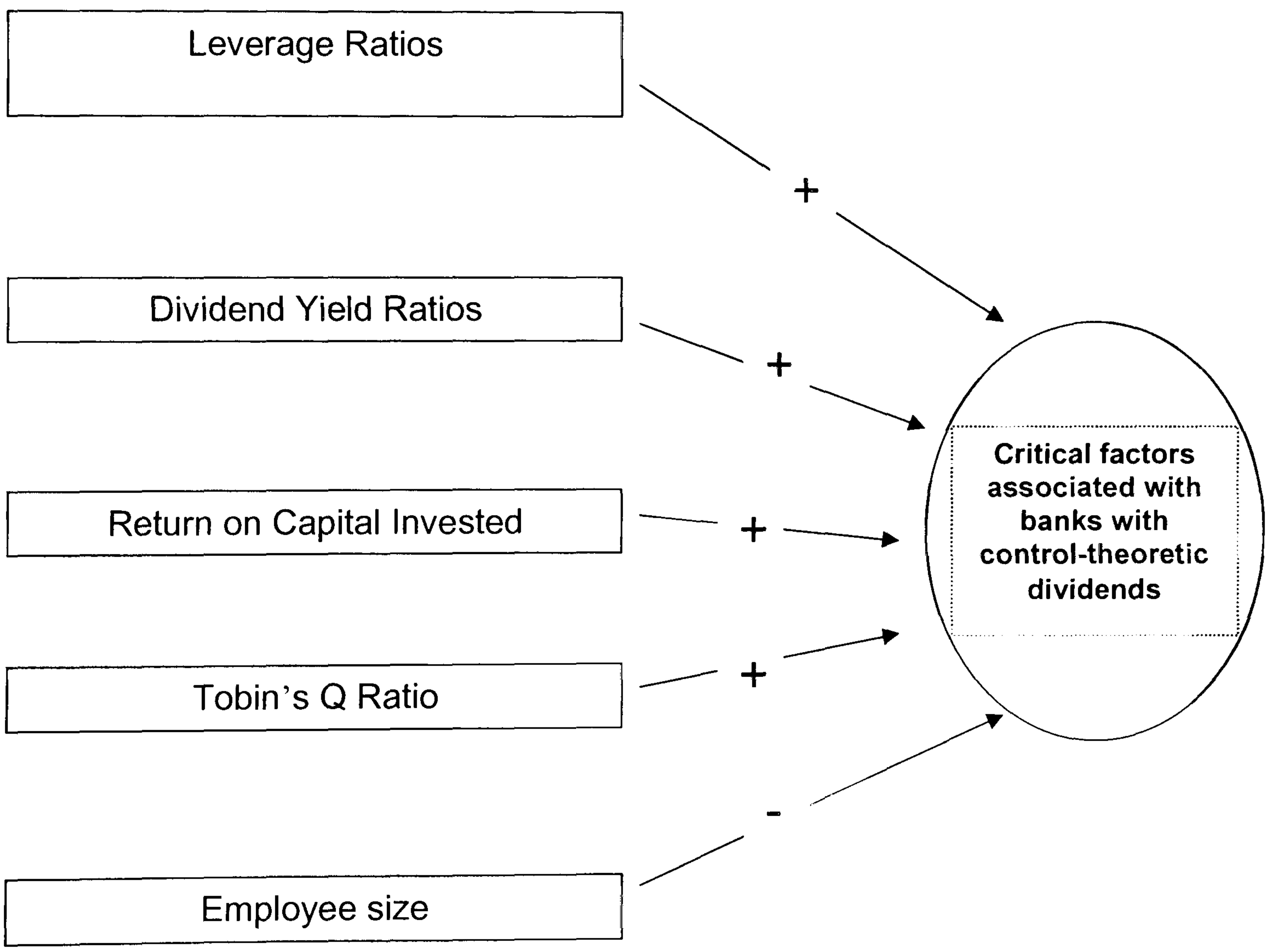
Banks with control-theoretic dividend patterns have a probability, *p*, of at least 0.5.

Reporting the results of the final Step-wise Logistic Regression for the whole sample after having removed the key unusual residuals: **The banking corporations listed on the New York Stock Exchange (NYSE)** **Results : With regional dummies**
Six rows were removed from the original input data which represented two firms and three years of data. The estimates in the regression were similar to the original regression without removing these outliers.

6.4 Discussion of results

As mentioned in Section 6.2 above, the application of the logistic regression analysis and step-wise regression procedure established the factors listed in Diagram 6.4 below as the factors that govern the fitness of the optimal control theory model in dividend determination. The nature of the different relationships is also shown in Diagram 6.4.

Diagram 6.4 Factors that govern banks with control-theoretic dividends



In summary, taking into consideration the above results contained in Diagram 6.4, the optimal control theory model tends to associated with small (by employee size) NYSE banks, which perform financially well and possess a strong share price, as indicated by the high Tobin's Q ratio, higher dividend yield, a greater return on capital invested, and a higher leverage.

Considering further the factors identified in Diagram 6.4 above, the results of this study reveal that the potential contenders that are likely to be applicable to apply the optimal control theory tend to be associated with:

- Higher leverage ratio = (Total debt / shareholder's equity); and higher leverage ratios tend to be associated with banks that have high customer confidence. This is evidenced in this study by the high leverage figures (a combined short term and long term debt measure), implying for banks typically high short term debt in the leverage figures, i.e. high customer deposits, which reflects high customer confidence and hence shows that the bank is doing well.

  For banking corporations, the leverage calculations include customer deposits in the total debt figures, and hence resulting in the above mentioned higher leverage figures. A good example in the UK during 2007 was the Northern Rock case which clearly exposed that, when customers' confidence in a bank is lost, customers tend to withdraw their deposits from the bank. Therefore, a bank with high deposits would tend to reflect that the bank customers are comfortable with the bank's safeguarding their deposits, hence reflecting the customers' confidence.

A high financial leverage ratio would otherwise normally indicate a substantial proportion of debt financing the business; this could be the norm particularly in other industries. In itself it would indicate high risk, but in the banking industry higher leverage does not in itself indicate risk as explained above.

- The high dividend yield stated above reveals that the control theory model fits well in banking corporations that issue a high dividend to price figure for each share. The high dividend yield figure is normally associated with banking corporations that perform well in the economic environment and present opportunities to engage in value investing (see the high return on capital invested).

  In other instances a high dividend yield could signal the following:

  - that stock prices are rapidly declining (low share prices) and
  - that there is not room for further dividend increases or possibly in the extreme there could be dividend cuts. This scenario is less preferred by investors who want a steady dividend increase to indicate that the business is healthy enough over periods of time to return cash to shareholders.

This is not the case in this particular study, because the high Tobin's Q ratio reveals that the banks possess high share prices, compared with book values, therefore indicating that the banks perform effectively in the market place.

- The high return on capital invested mentioned above shows that the banks with control-theoretic dividends tend to possess high net profitability that is generated by the bank's investments. The high return on capital invested ratios are associated with healthy banking corporations that are performing successfully and that use the customers' funds profitably.

- The banking corporations with a small number of employees are mostly associated with the small banks.

- The Tobin's Q ratio =

[Total market value of the organisation (according to price traders) / Current cost of replacing the company's existing assets]

The Tobin's Q ratio is a ratio of the total market value of the company against the current cost of replacing the firm's existing assets. A high Tobin's Q ratio occurs when a firm's market value is high relative to the asset replacement cost. As mentioned above, this implies that the shares of the control-theoretic banks are highly valued. The high Tobin's Q ratio indicates that these banks tend to be expanding banking corporations (or have high growth potential), making active investment decisions and possibly possessing high unrecorded goodwill, suggesting a relatively low book value.

Table 6.2 above reveals that the foreign banks listed on the NYSE, USA Mid-Atlantic and the USA Pacific regional banks have a critical influence on identifying the factors that govern the banks with control-theoretic dividends. The foreign banks and the USA Mid-Atlantic banks in general do not have control-theoretic dividends. But, most USA banking corporations, especially the Pacific regional banks, have control-theoretic dividend patterns.

6.5 Conclusions

Chapter 6 answers the second key research question which endeavours to investigate and identify the factors that are associated with banks that display control-theoretic dividend patterns. Tables 6.1 and 6.2 detail the main factors that govern the fitness of the optimal control theory model. An analysis of the results suggests that the small healthy USA banking corporations which possess signs and evidence of paying good dividends to shareholders and that are successful and growing tend to describe the banks with control-theoretic dividends.

CHAPTER 7: IDENTIFYING THE FACTORS THAT ARE ASSOCIATED WITH BANKS THAT OUT- PERFORM THE CONTROL THEORY FRAMEWORK

7.1 Introduction

The key objective of Chapter 7 is to identify the main dividend policy factors that are associated with the out-performers of the optimal control theory model. The procedures employed to identify the factors that are associated with the out-performing banks are detailed in Section 7.2 below. Section 7.3 presents the results of the chapter. While Section 7.4, discusses the results, and finally Section 7.5 conclusions the chapter.

7.2 The procedures applied to identify the factors that are associated with the out-performers of the optimal control theory model

The key research question being answered in the final phase of the study is given above in Section 4.4.1.3.The dividend policy factors that are examined in this part of the study are the factors that the literature has identified as influencing dividend policies in organisations (see Table 4.4 above).

To achieve the objectives of this chapter, this study made some research assumptions, which are explained in Chapter 5 above (see Section 5.2). Details of the hypotheses that are tested in the final phase of the study are presented in Chapter 4, Section 4.4.1.3. Given below are the four procedures that were conducted for Chapter 7:

Stage 1:

This stage involved identifying all the NYSE banks that constitute the research sample and recording them onto a spreadsheet.

Stage 2:

The following two categories of information were collected for each bank mentioned above:

- The first set of information collected includes the independent variables (X variables) given in Table 4.4.

The second set of information needed for each bank was the appropriate dependent variable (Y variable). The dependent variable for each bank was created by using the process explained above in Sections 5.2.4 and 6.2 to establish the dividend divergence rate (DDR).

Control-theoretic dividend rate	***LESS***	Actual dividend rate of NYSE banks	=	DDR (negative for out-performers; positive for under-performers)

Stage 3:

The above mentioned two groups of data:

- the Y variables and
- the X variables,

for each bank were entered accordingly onto a single spreadsheet to form one data set.

Stage 4:

The above mentioned single data set produced was up-loaded onto Statgraphics plus version 5.1, and the multiple regression analysis and multiple stepwise regression analysis were applied to identify the factors that are related to the out-performers of the control theory framework (out-performing banks of the control theory framework have actual dividends that are higher than the control-theoretic dividends).

7.3 Results

Table 7.1 below exhibits the results of the final multiple step-wise regression analysis, which provides the information regarding the factors associated with DDR (negative for outperformers, and positive for underperformers).

Final Step-wise Regression for the whole sample (of banking corporations listed on NYSE)

Parameter	Estimate	t - Statistic	P-Value	Other statistic
Constant	-1.025	-4.317	0.0000***	-
Dividend Yield Ratio	-241260	-4.239	0.0000***	-
Return on Equity Ratio	-42602	-4.636	0.0000***	-
Revenue Growth Ratio	-15027	-2.816	0.0050***	-
Tobin's Q Ratio	927608	1.593	0.1*	-
Dividend Payout Ratio	10932	3.905	0.0001***	-
Income Growth Ratio	8923	2.777	0.0057***	-
Size of Employees	645706	7.681	0.0000***	-
F-Ratio	-	-	-	12.12
ANOVA P-Value	-	-	-	0.0000***
R-squared	-	-	-	13.079%
R-squared (adjusted for d.f.)	-	-	-	12.000%

Notes : ***= significant at 99% confidence level; **= significant at 95% confidence level and *= significant at 90% confidence level

Initially all the appropriate variables of the NYSE banks that constitute the whole research sample were included in a full multiple regression and which included dummy variables for every region except one. All dummy variables could not be included simultaneously because of linear dependence. The insignificant variables were removed through step-wise regression and the relevant dummy variables were also removed as required by the step-wise regression analysis.

Summary of the factors that characterise the out-performers of the control theory framework:

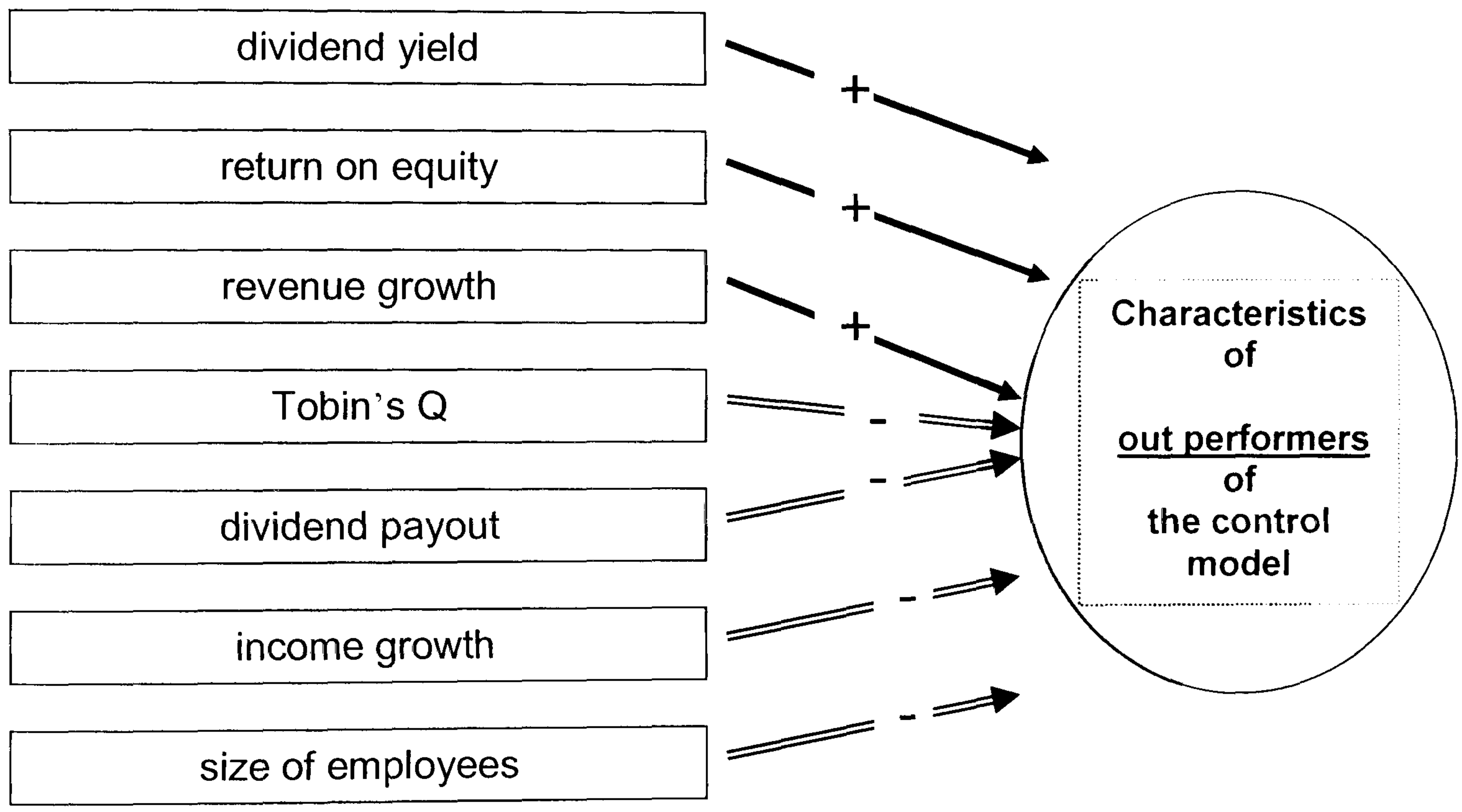
1. higher dividend yield ratio,
2. higher return on equity ratio,
3. higher revenue growth ratio,
4. lower Tobin's Q ratio
5. lower dividend payout ratio,
6. lower income growth ratio, and
7. lower size of employees.

(*Vice versa* for under-performers)

7.4 Discussion of results

Diagram 7.4 below shows the nature of the relationships that exists among the factors that tend to be associated with out-performing banks.

Diagram 7.4: Relationships of the factors that are associated with the out-performers of the control theory model



It is important to appreciate that the factors identified in Chapter 6 as governing the NYSE banks with control-theoretic dividends also apply to the group of banks that are classified here in Chapter 7, as the out-performers of the control theory model. In addition to the factors identified on Diagram 6.4 as being associated to the banks with control-theoretic dividends, the out-performers of the control theory framework possess the following: higher dividend yield, higher return on equity, higher revenue growth, lower dividend payout, lower Tobin's Q, lower income growth and smaller employee size.

Discussing the results of the out-performers in more detail; the higher return on equity and the higher revenue growth ratios show that out-performers tend to attain higher profits from the equity capital raised from shareholders and also have an implied growing customer base.

The Tobin's Q ratio compares the market value of the company to the current cost of replacing the firm's existing assets. A lower Tobin's Q value, as is the case here, implies that lower growth potential for the future.

Chapter 6 mentions that higher dividend yield figures may mean that the stock price is relatively low and this may present opportunities for investors to engage in value investing activities. However, the profitability is higher, so this is unlikely to be the case. Diagram 7.5 indicates a healthy state of affairs for out-performers through the higher revenue growth rate and the higher return on equity, although there is a lower income growth rates. Traditionally, high dividend yields are associated with leading firms in mature industries, which can afford to payout high dividends. Indeed here the payout ratios are smaller for the out-performers. Out-performers here are smaller in size, and more profitable.

7.5 Conclusions

A number of dividend policy determinants presented in Table 4.4 were subjected to the multiple regression analysis and step-wise regression analysis accordingly to identify the factors associated with NYSE banks that out-perform the control theory framework.

The results reveal that out-performing banks:

- have higher profits, as indicated by the higher return on equity, and an implied expanding customer base, as suggested by the higher revenue growth rate;
- have higher dividend yields, constrained by an implied internally imposed conservative retention policy, as indicated by lower payout ratios;
- tend to be smaller in size.

The focus in the next final chapter of the thesis, Chapter 8, is to present the thesis' conclusions and to lay out the direction of future research arising from this study.

CHAPTER 8 THESIS CONCLUSIONS AND DIRECTION OF FUTURE RESEARCH

8.1 Introduction

Chapter 8 has three key objectives: to present the overall findings of this research study, to discuss the limitations of this study, and to suggest the direction of future research.

Chapter 8 contains the following different sections: Section 8.2 summarises the main purpose of this study and the fundamental issues investigated by this study. Section 8.3 details the overall findings of this study, Section 8.4 presents the limitations of this research, Section 8.5 provides the direction of future research and finally Section 8.6 concludes the chapter.

8.2 The main purpose of this research and key issues investigated by this study

The main purpose of this research was to investigate the dividend behaviour of NYSE banks within the optimal control theory framework. This study investigated the dividends of NYSE banking corporations in three stages as follows:

- The first stage carried out investigations on the initial research idea which was developed following Davidson's (1980) suggestion which states that the infinite horizon model and hence the long planning (T=100) horizon model are not likely to be good explanators of observed behaviour. The initial stage of this research establishes the control planning horizons that determine the control-theoretic dividend patterns for the NYSE banks successfully. The initial hypotheses and the work carried in the initial stage are presented in Chapter 4, Section 4.4.1.1 and Chapter 5.

- Stage two utilised some relevant results attained in stage one to identify the factors that govern control-theoretic dividend patterns. Details of the procedures carried in the second stage and the associated hypotheses applicable to stage two are detailed accordingly in Chapter 4, Section 4.4.1.2 and Chapter 6, Section 6.2.
- Finally, stage three followed on after attaining the results of stage one and stage two. The third phase managed to identify the factors that are related to the out-performers of the control theory framework. The out-performers of the control theory model are determined by the procedure presented in Chapter 7, Section 7.2. The relevant hypotheses tested in the final stage are given in Chapter 4, Section 4.4.1.3.

8.3 Summary of the research findings

The results of this research project reveal the following:

8.3.1. Stage one results

There exists an optimal control planning horizon for each banking corporation, which enables the determination of optimal dividends for each particular organisation. Therefore, a NYSE banking corporation would have to identify a unique specific control planning horizon, ideal to suit the bank's particular circumstances, when determining the control-theoretic dividend patterns for the bank.

Results also revealed that some NYSE banks have actual dividend patterns similar to control-theory dividend patterns. Other NYSE banks do not have actual dividends being similar to the control-theoretic dividend patterns. Therefore, some banking corporations listed on the NYSE are able to use the optimal control theory model for dividend determination, while other banks are unable to apply the optimal control theory.

Results suggest that this study should reject alternative hypothesis 1 (H_1), which states that low finite control planning horizons determine the level of dividends, of NYSE banking corporations, and must not reject the first null hypothesis ($H_{0(1)}$) , because the research findings confirm that high finite control planning horizons, such as T= 100, tend to determine the control-theoretic dividend patterns.

This study further exposed that with regards to banks listed on the NYSE, the foreign banks listed on the stock market, the USA Mid-Atlantic and the USA Pacific regional banks have a critical influence in identifying whether banks possessed control-theoretic dividend patterns or not. The foreign banks and the Mid-Atlantic banks in general contained banks that did not possess control-theoretic dividends. The Pacific regional banks do, however, possess a high number of banks with control-theoretic dividend patterns.

8.3.2. Stage two results

Results of this study suggest that the control-theoretic dividend patterns are likely to be associated with NYSE banks that are small in size, perform financially well, perform well on the stock market by possessing a very strong share price, possess high investment potential, pay significant dividends to shareholders, and finally are financed significantly by relatively large amounts of debt in relation to equity capital.

The research results indicate that the propensity of a NYSE bank to possess control-theoretic dividend patterns is governed by the following relationships:

- higher leverage (as shown by a positive relationship between the leverage ratio and the control-theoretic dividend pattern variable, which is a '1' in the logistic regression analysis),

- higher dividend yield (as shown by a positive relationship between dividend yield ratio and control-theoretic dividend pattern variable).

- a greater return on capital invested (as shown by a positive relationship between return on capital invested ratio and control-theoretic dividend pattern variable).

- a higher Tobin's Q (as shown by a positive relationship between Tobin's Q ratio and control-theoretic dividend pattern variable), and

- a smaller number of bank employees (as indicated by a negative relationship between the bank size variable and control-theoretic dividend pattern variable)

While on the other hand dividend policy literature identified the following as factors that influence dividend policy in corporations:

- lower investment (indicated by a negative relationship of dividend yield (dividend policy) with investment opportunities)

- lower risk (indicated by a negative relationship of dividend yield with risk factors)
- lower insider ownership (indicated by a negative relationship between dividend policy with insider ownerships)
- large bank sizes (indicated by a positive relationship between dividend yield with size of the bank)
- higher dividend history (indicated by a positive relationship between dividend yield with dividend history).

Table 8.3.2: Results of the relationship that exists between the factors that govern control-theoretic dividend patterns and the factors identified in the literature as influencing corporate dividend policy

	Factors that literature has found as influencing dividend policies in corporations	Factors that govern control-theoretic dividend patterns in NYSE banks	Are factors the same?	Alternative Hypothesis Do not reject (Accept) **or** do not accept	Null Hypothesis Do not reject (Accept) **or** do not accept
1	lower investment	A higher Tobin's Q and a greater return on capital invested (indicating high growth potential for investment oportunities)	**X**	hypothesis H_{2A} - do not accept	null hypothesis $H_{0(2A)}$ - Do not reject **(Accept)**
2	lower risk	less diversified, focused and low risk	√	hypothesis H_{2B} - Do not reject **(Accept)**	null hypothesis $H_{0(2B)}$ - do not accept
3	large bank sizes	small bank sizes	**X**	hypothesis H_{2C} - do not accept	null hypothesis $H_{0(2C)}$ - Do not reject **(Accept)**
4	Higher historic dividend	high dividend yield	√	hypothesis H_{2D} - Do not reject **(Accept)**	null hypothesis $H_{0(2D)}$ - do not accept
5	lower insider ownership	*variable Not included in the study*	-	-	-
6	*variable not applicable to dividend policy literature*	Higher leverage	-	-	-

The results contained in Table 8.3.2 show that this study should not reject the following hypotheses:

- hypothesis H_{2B} , which suggests that an association exists between the control-theoretic dividend patterns and low risk, and
- hypothesis H_{2D}, which suggests that an association exists between the control-theoretic dividend patterns and possessing a history of high dividends.

This study should also not reject the following null hypotheses:

- null hypothesis $H_{0\,(2A)}$, which suggests that no association exists between the control-theoretic dividend patterns and low investment, and
- null hypothesis $H_{0\,(2\backslash C)}$, which suggests that no association exists between the control-theoretic dividend patterns and being a large bank.

This study, therefore, suggests that with regards to NYSE banking corporations, the presence of the factors that literature identifies as influencing corporation dividend policies do not necessarily govern the control-theoretic dividend patterns in NYSE banks, but instead other relevant variables, such as a higher leverage, higher investment potential and small bank size also tend to be associated with the control-theoretic dividend patterns.

8.3.3. Stage three results

The out-performers of the optimal control theory framework tend to possess the following characteristics:

- a higher dividend yield,

- a higher return on equity,
- a higher revenue growth rate,
- a lower dividend payout ratio,
- a lower Tobin Q ratio,
- a lower income growth,
- a higher return on equity, and
- a smaller employee size.

The above mentioned factors simply suggest that out-performers of the control theory framework are associated with banks that have higher profits, as indicated by the higher return on equity, and an implied expanding customer base, as suggested by the higher revenue growth rate. Out-perfoming banks also have higher dividend yields, constrained by an implied internally imposed conservative retention policy, as indicated by lower payout ratios, and they tend to be smaller in size.

Table 8.3.3: Results of the relationship that exists between the out-performers of the control theory framework and the factors identified in the literature as influencing corporate dividend policy

	Factors that literature has found as influencing dividend policies in corporations	Factors that govern control-theoretic dividend patterns in NYSE banks	Are factors the same?	Alternative Hypothesis Do not reject (Accept) **or** do not accept	Null Hypothesis Do not reject (Accept) **or** do not accept
1	lower investment	a lower Tobin's Q and a high return on equity (indicating high profits being made but lower investment opportunities)	√	hypothesis H_{3A} - Do not reject **(Accept)**	null hypothesis $H_{0(3A)}$ - do not accept
2	lower risk	highly diversified and high risk	**X**	hypothesis H_{3B} - do not accept	null hypothesis $H_{0(3B)}$ - Do not reject **(Accept)**
3	large bank sizes	smaller bank (employee) sizes	**X**	hypothesis H_{3C} - do not accept	null hypothesis $H_{0(3C)}$ - Do not reject **(Accept)**
4	higher dividend history	higher dividend yields	√	hypothesis H_{3D} - Do not reject **(Accept)**	null hypothesis $H_{0(3D)}$ - do not accept
5	lower insider ownership	*variable not included in the study*	-	-	-
6	*variable not applicable to dividend policy literature*	lower income growth ratio	-	-	-

Table 8.3.3 shows that this study should not reject hypothesis H_{3A} which suggests an association between out-performers and lower investment opportunities. This research should also not reject hypothesis H_{3D} which suggests an association between out-performers and a history of higher dividends.

This study should also not reject the following null hypotheses:

- null hypothesis $H_{0\ (3B)}$, which suggests that out-performing banks do not possess low risk, and
- null hypothesis $H_{0\ (3C)}$, which suggests that out-performing banks are not large,

This study suggests that with regards to NYSE banking corporations additional factors such as lower dividend payout ratios and lower income growth also tend to be associated with out-performing banks. The other variables which were identified as being part of the dividend policy literature but not associated with out-performers include lower risk and larger bank sizes. This indicates a slight discrepancy between the dividend policy literature and the findings of this research study.

8.3.4. Further implications of dividend policy literature on this study

The dividend policy literature confirmed that dividend policy is relevant to financial management mainly because it has a significant impact on company share valuation and cost of capital calculations, and cost of capital affects the capital investment decision of the organisation and the economic growth of the economy.

Past research on dividend policy has been greatly useful to this study because the factors that have been identified in literature as influencing dividend policy have been utilised to constitute the required key elements that were tested in this study.

Chapter 2 identified the key challenges presented in the literature that confront the dividend puzzle matters. In support of Davidson (2002), this study emphasises the need for future dividend policy research which strives towards developing a unified rationalised corporate dividend policy, as a number of current different theories on corporate dividend policy are logical but completely disjointed. More work aimed at unifying dividend policy theory would be absolutely essential to company policy makers who are operating in this complex modern economic environment, who also tend to constantly seek any useful guidance from literature when they devise corporate policies.

8.4 The limitations of this research

This research was specifically limited to a sample of banking corporations which happened to be performing well on the stock market and that have issued dividends over the past years. This study might be difficult for struggling organisations that have never been able to issue out dividends in the past years. Therefore, it is a weakness of this study that it may not be suitable to all corporations.

This research is limited to NYSE banking corporations only; other banking corporations listed in other countries should be examined in the future to establish if similar results are attained when the optimal control theory framework is applied to determine future dividends for the corporations.

To identify factors that are associated with the banks that possess control-theoretic dividend patterns, the logistic regression analysis methodology was applied as it is an effective and efficient way of determining the required factors. It is the weakness of this research project that it did not explore other current research methodologies that could have produced similar results to the results produced by the logistic regression analysis. For example, the probabilistic or multi-layer feed forward nets research methodologies could have been explored to establish their effectiveness and efficiency in identifying the key factors. Perhaps future research could utilise the above mentioned methodologies and establish their usefulness in identifying the required factors.

8.5 The direction for future research

The following are the recommended future research areas:

- It would be great to investigate the behaviour of the optimal control theory in other major active stock markets in the world such as Tokyo, London and German stock markets. Making relevant comparisons between the results of different stock markets would be worthwhile. These future tests should not be limited to the banking corporations only, but should extend to other industrial sectors listed on stock markets.
- The optimal control theory framework presented by Davidson (1980) has the abilities to determine concurrently, future dividend levels and future liquid asset levels. This research only considered the behaviour of the future dividend levels, and did not consider the behaviour of the future liquid asset levels. Future empirical research needs to observe also the behaviour of the liquidity levels, mentioned above.

8.6 Conclusion

This study has managed to enhance the knowledge of an optimal control theory framework when the control framework is applied in practice. The findings of this study significantly contribute to current literature, as this research clearly established that the specific NYSE banking corporations possess control-theoretic dividend patterns described above in Chapters 5 and 6. Undoubtedly Chapter 7 successfully exposed the key characteristics of the NYSE banks with observed dividends that out-perform the dividends determined by the optimal control theory framework.

Chapter 8 wraps up this thesis by suggesting weaknesses that should be considered in the future. Future research is very important as it will form an essential extension to this thesis which will further enhance the current knowledge of the optimal control theory framework for dividend determination.

Future empirical work is vital for further knowledge generation in this area; therefore researchers are encouraged to continue active research in this subject matter of dividend determination.

Appendix 1 – Procedure followed by this study to calculate the cost of capital

The following is the procedure that this research followed to obtain the cost of capital for this study:

Step 1 :

Firstly, this study collected the USA Risk Free Rate (to estimate the risk free rates the USA ten year government bonds were used by this study as the estimate)

The source for the USA ten year government bonds was: The Financial Times news paper of Thursday, January 26 2006, the market date column.

An example of the US risk free rates collected by this study are contained in

Table A1A . This is abbreviated as R_F and is given as a percentage (%) in Table A1A.

Step 2:

Secondly, this study collected the systematic risk values (the Beta values) for each bank in the sample. The source of the systematic risk, Beta values were from the information published by ADVFN. The systematic risk values are abbreviated as β in the given Table A1A.

Step 3:

Thirdly, this study collected the risk premium figures. Risk premium is equal to market rate less risk free rate (R_M - R_F). The estimates of the risk premium were obtained from the results of the research study carried out by Omran and Pointon (2003). The risk premium estimates that were obtained by Omran and Pointon (2003) were very similar and inline with risk premium estimates obtained by the study conducted by Claus and Thomas (2001). The risk premium estimates for the USA was estimated by the two studies as 5.4. The risk premium value is abbreviated as (R_M - R_F) in the given Table A1A below.

Step 4:

Finally at the above elements of the cost of capital were feed on to an excel solver spreadsheet which calculated the cost of capital.

The CAPM Formula = Ke =R_F + β*(risk premium)

An extract example of the excel spreadsheets used to calculate the cost of capital is given below: - Table A1A.

Appendix 1

Table A1A: Cost of capital calculations for all the banks in the research sample (an example)

This is an example of the spreadsheet used by this study to record all the collected required variables for each NYSE

CAPM Formula = $Ke = R_F + \beta$*(risk premium)	Cost of Capital Ke =	US Risk Free Rate (USA Ten Year government Bonds) Source: Financial Time of Thursday, January 26 2006 Market Date column	Beta Source: Published by ADVFN	Risk Premium figures are the results of the research study by: Omran and Pointon (2003), which are inline with risk premium estimates of Claus and Thomas (2001).
	Cost of Capital %	%		Risk Premium
Name of US Money Centre Bank	Ke =	R_F +	β	$(R_M - R_F)$
Bank of America	7.5	4.8	0.5	5.4
Canadian Imprl bank	8.094	4.8	0.61	5.4
Bank of New York	12.792	4.8	1.48	5.4
Bank of Montreal	7.014	4.8	0.41	5.4
Bank of Nova Scotia	8.094	4.8	0.61	5.4
CITIGROUP	11.766	4.8	1.29	5.4
Community Natl corp OHIO	4.098	4.8	-0.13	5.4
Cooperative Bankshares	5.934	4.8	0.21	5.4
JPMorgan Chase & Co	13.872	4.8	1.68	5.4
KEY CORP	7.338	4.8	0.47	5.4
Mellon Financial CORP	11.82	4.8	1.3	5.4
Nationl Bancshares	5.178	4.8	0.07	5.4
Oriental Financial Group	7.122	4.8	0.43	5.4
Ohio Legacy Corporation	11.118	4.8	1.17	5.4
PNC Financial SVCS GRP	9.228	4.8	0.82	5.4
SUNTRUST banks INC	6.69	4.8	0.35	5.4
TCF Financial Corp	7.014	4.8	0.41	5.4
Toronto Dominion Bank	10.308	4.8	1.02	5.4
United Bancshares INC	4.8	4.8	0	5.4
Wachovia Corporation	7.932	4.8	0.58	5.4
Wells Forgo & Company	6.312	4.8	0.28	5.4

The table below shows an example of the sheet used to collect the research data

Table A1B – The variables record sheet (an example)

Variables record sheet :		**Variables record sheet :**	
Debt Ratio	*published by ADVFN*	Debt Ratio	
Gearing Ratio	*published by ADVFN*	Gearing Ratio	
Leverage Ratio	*published by ADVFN*	Leverage Ratio	
Dividend Yield	*published by ADVFN*	Dividend Yield	
Dividend Payout Ratio	*published by ADVFN*	Dividend Payout Ratio	
Return on Equity	*published by ADVFN*	Return on Equity	
Return on Assets	*published by ADVFN*	Return on Assets	
Return on Capital Invested	*published by ADVFN*	Return on Capital Invested	
Revenue Growth Rate	*published by ADVFN*	Revenue Growth Rate	
Income Growth Rate	*published by ADVFN*	Income Growth Rate	
Dividend Growth Rate	*published by ADVFN*	Dividend Growth Rate	
Cash flow Per Share	*published by ADVFN*	Cash flow Per Share	
Tobin's Q Ratio	*published by ADVFN*	Tobin's Q Ratio	
Share price / book value of assets	*published by ADVFN*	Share price / book value of assets	
Number of Employees	*published by ADVFN*	Number of Employees	
Bank name : **Bank of America**		**Bank name: Bank of New York**	

Appendix 2

Table App. 2 Details of the independent variables selected by this study

Table App. 2	Variable	Formulae	Notes
1	Debt Ratio	**Debt ratio = Total debt / Total assets**	*This variable has been identified by Meric.G, et al (2002 and other dividend policy literature as a significant determinate of dividend policy. Debt ratio measures how much a company relies on debt to finance assets.*
2	Gearing Ratio	**Loan Capital / total capital employed**	*This variable has been identified by Meric.G, et al (2002 and other dividend policy literature as a significant determinate of dividend policy. Gearing ratio measures the percentage of capital employed that is financed by debt. Higher percentage of gearing ratio shows company is borrowing highly.*
3	Leverage Ratio	**Total debt / Shareholder's equity**	*Meric.G, et al (2002), identified leverage as a significant determinate of dividend policy. Leverage is the degree to which a company utilises borrowed money.*

4	Dividend Yield	**Dividend policy (dividend yield) = dividend per share / share price**	*This is the yield a company pays out to shareholders.*
5	Dividend Payout Ratio	**Dividend policy (payout ratio) = dividend paid / net income (profit)**	*This compares the dividends paid to the earnings that are received by a company*
6	Return on Equity	**Net Income (One yr's earning)/ Shareholder's Equity**	*Meric.G, et al (2002) and other dividend policy literature identified profitability ratios as a significant determinate of dividend policy.*
7	Return on Assets	**Net Income (One yr's earning)/ Total Assets**	*Meric.G, et al (2002) and other dividend policy literature identified profitability ratios as a significant determinate of dividend policy.*
8	Return on Capital Invested	**Net Income (One yr's earning)/ Capital Invested**	*Meric.G, et al (2002), identified profitability ratios as a significant determinate of dividend policy.*

9	Revenue Growth Rate	**Revenue growth rate = Total current revenue now <u>LESS</u> previous revenue /previous revenue**	*This variable indicates the expansion of the company's revenues, hence shows potential future organisations strength*
10	Income Growth Rate	**Income growth rate = Total current income now <u>LESS</u> previous income/previous income**	*This variable indicates the expansion of the company's income, hence shows potential future organisations strength*
11	Dividend Growth Rate	**Dividend growth rate = Total dividend now <u>LESS</u> previous dividend/previous dividend**	*This variable indicates the expansion of the company's dividends*
12	Percentage of the cash flow in the share price	**Percentage of the cash flow in the share price = (Cash flows per share/ share price) *(100) = [(Cash flow / number of shares)/(Share price)]*100**	*This measure the bank's liquidity*
13	Tobin's Q Ratio	**Total market value of the company (Price traders are welling to buy and sell shares)/ Current cost of replacing firm's existing assets Or**	*The Tobin's Q ratios were published for each bank on the ADVFN database. This ratio indicates how healthy a company is in the view of the stock market. The Q ratio compares the value of a company given by financial markets with the value of a company's assets. Another use*

		Value of stock market / corporate net worth *[Tobin's Q ratios were published by ADVFN for every NYSE bank]*	*for Q is to determine the valuation of the market as a whole. The formula for this q is: value of stock market / corporate net worth Q ratio shows how the market views the company. Tobin Q ratio greater than one is good. Shows that firm is worth more than value of its assts and has done well. A Tobin's Q greater than 1.0 shows that the market value is greater than the value of the company's recorded assets. This suggests that the market value reflects some unmeasured or unrecorded assets of the company. High Tobin's Q values encourage companies to invest more in capital investments because they are "worth" more than the price they paid for them.* *On the other hand, if Tobin's Q is less than 1, the market value is less than the recorded value of the assets of the company. This suggests that the market may be undervaluing the company.* *Diversified companies tend to have a lower Q-ratio than focused, low risk firms because the market under-evaluate the value of the firm assets.*

14	Share price / Book value of assets	**Price / Book Ratio** **[Market to Book Value Ratio]**	*This ratio indicates how a company is perceived by the market.*
15	Log of the Number of employees	**Size of the Bank**	*This shows the size of the organisation*
16	DDR	**See Chapter 5**	*Construction of DDR variable is detailed in chapter 5 of this thesis*

Appendix 3 –

Table App 3 below shows the statistics of banks listed on the NYSE as of August 2006, the names of the banks listed on the NYSE are contained in Appendix 4 below.

Appendix 3 – Table App 3 Statistics of Banks listed on the NYSE as of August 2006

Table - App 3	**Regional Group of NYSE Banks**	**Approximated Total Number Of banks**
1	Money centre banks	21
2	Northeast banks	228
3	Mid-Atlantic banks	198
4	Southwest	80
5	Midwest	118
6	Southwest	48
7	Pacific	212
8	Foreign money centres	16
9	Foreign regional banks	26
10	Savings and Loans	292
	Total	**Approximately 1239**

Appendix 4 –

Appendix 4 below contains the list of banks listed on the NYSE as of August 2006.

Appendix 4 – Tables App 4- Examples of banking corporations listed on the NYSE as of August 2006

Money Centre Banks
BANK OF AMERICA CORP
BANK OF MONTREAL
BANK OF NEW YORK CO INC
BANK OF NOVA SCOTIA THE
CANADIAN IMPRL BNK OF CO
CITIGROUP INC
COMMUNITY NATL CORP OHIO
COOPERATIVE BANKSHARES
FIRST DATA CORP
JPMORGAN CHASE & CO
KEYCORP
MELLON FINANCIAL CORP
NATIONAL BANCSHARES OH
OHIO LEGACY CORPORATION
ORIENTAL FINANCIAL GROUP
PNC FINANCIAL SVCS GRP
SUNTRUST BANKS INC
TCF FINANCIAL CORP
TORONTO DOMINION BANK
UNITED BANCSHARES INC
WACHOVIA CORP
WELLS FARGO & CO

Regional – Northeast Banks	Regional - Northeast Banks	Regional - Northeast Banks
1ST CENTENNIAL BANCORP	BANKNORTH GROUP INC	CENTRAL JERSEY BANCORP
1ST COLONIAL BANCORP	BAR HARBOR BANKSHARES	CENTRIX BANK & TR
ADVANTAGE BANK NJ	BERKSHIRE BANCORP INC	CENTURY BANCORP INC CL A
ALLAIRE COMMUNITY BANK	BEVERLY NATIONAL	CENTURY FINANCIAL CORP
ALLEGHENY VY BANCORP	BOARDWALK BANK	CFS BANCORP INC
ALLIANCE BANKSHARES CORP	BOSTON PRIVATE FINCL HLD	CHITTENDEN CORP
ALLIANCE FINANCIAL CORP	BRIDGE BANCORP INC	CHRISTIANA BANK & TRUST
AMERICAN BANK INC	BRYN MAWR BANK CORP	CITIZENS BANCORP PA
AMERISERV FINANCIAL INC	CAMBRIDGE BANCORP	CITIZENS FINANCIAL SVCS
AMES NATIONAL CORP	CAMDEN NATIONAL CORP	CITIZENS HOLDING CO
APPLE VALLEY BANK & TR	CANANDAIGUA NATIONAL CP	CITIZENS NATL BANCORP
ARROW FINANCIAL CORP	CANTON BANCORP INC PA	CNB BANCORP INC NY
ASIAN AMER BK & TR CO A	CAPITAL BANK & TRUST NY	CNB FINANCIAL CORP
ATLANTIC COAST FED CORP	CAPITAL CROSSING BANK	CNB FINANCIAL CORP
BALLSTON SPA BANCORP	CB FINANCIAL SERVICES	CODORUS VALLEY BNCP INC
BANCORP RHODE ISLAND INC	CBT FINANCIAL CORP	COLUMBIA FINANCIAL
BANK OF NEW CANAAN (CT)	CCFNB BANCORP	COMM BANCORP INC
BANK OF UTICA (NY)	CENTER BANCORP INC	COMMERCE BANCORP INC
BANK OF UTICA NY NON VTG	CENTRAL BANCORP INC	COMMUNITY BANCORP VT

Regional – Northeast Banks	Regional - Northeast Banks	Regional - Northeast Banks
COMMUNITY BANK & TR NH	FACTORY POINT BNCP	FIRST VALLEY BANCORP INC
COMMUNITY BANK SYSTM INC	FIDELITY BANCORP INC	FIRST WASHINGTON FNCL
COMMUNITY BANKS MLRBG PA	FIDELITY D&D BANCORP INC	FNB BANKSHARES MAINE
COMMUNITY BK BERGEN NJ	FIRST CENTURY BANKSHARES	FNB FINANCIAL CORP PA
COMMUNITY CAPITAL BNK NY	FIRST CHESTER COUNTY CP	FRANKLIN FINANCIAL SVCS
CONNECTICUT BANK & TR CO	FIRST CITIZENS BANCSHR B	FULTON BANCSHARES
CONNECTICUT RIVER COMM	FIRST CITY BANK CT	FULTON FINANCIAL CORP
CORNERSTONE BANCORP	FIRST COMMONWEALTH FINL	GNB FINANCIAL SERVICES
CORNERSTONE BANK NJ	FIRST CONSTITUTION BNCRP	GREATER COMMUNITY BNCP
DIMECO INC	FIRST FINANCIAL BANCORP	GREENE COUNTY BANCSHARES
EAST PENN FINANCIAL CORP	FIRST IPSWICH BANCORP MA	HAMLIN BANK & TRUST PA
ELMER BANCORP INC	FIRST KEYSTONE CORP	HARLEYSVILLE NATIONAL CP
ELMIRA SAVINGS BK FSB NY	FIRST KEYSTONE FINANCIAL	HARVEST COMMUNITY BANK
EMCLAIRE FINANCIAL CORP	FIRST LITCHFIELD FINCL	HILLTOP COMMUNITY BNCRP
EMPIRE STATE BANK	FIRST MORRIS BANK NJ	HINGHAM INSTITUTION SAV
ENTERPRISE BANK NJ	FIRST NATL CMNTY BNCP	HONAT BANCORP INC
EPHRATA NATL BK CAP	FIRST NATL LINCOLN CORP	HORIZON BANCORP (IND)
EVANS BANCORP INC	FIRST NORTHERN COMMUNITY	HUDSON UNITED BANCORP
EVERGREENBANCORP INC	FIRST OF LONG ISLAND CP	HUDSON VALLEY HLD
EXCHANGE NATIONAL BNKSHS	FIRST RESOURCE BANK	IBT BANCORP PA

Regional – Northeast Banks	Regional - Northeast Banks	Regional - Northeast Banks
IDAHO INDEPENDENT BANK	MASSBANK CORP	OCEAN SHORE HOLDING CO
INDEPENDENT BANK CORP MA	MAYFLOWER CO-OPER BANK	OMEGA FINANCIAL CORP
INTERCHANGE FINANCL SVCS	MBT FINANCIAL CORP	OREGON PACIFIC BANCORP
INTERVEST BNCSHS CP CL A	MERCHANTS BANCSHARES VT	ORRSTOWN FINANCIAL SVCS
IOWA FIRST BANCSHARES CP	MERRILL MERCHANTS BANCSH	PARKE BANCORP INC
IRON & GLASS BANCORP INC	MICHIGAN HERITAGE	PASCACK COMMUNITY BANK
JEFFERSONVILLE BANCORP	MID PENN BANCORP INC	PATRIOT NATL BANCORP INC
JUNIATA VALLEY NATL BANK	MNB CORP	PEAPACK-GLADSTONE FNL
LAKELAND BANCORP	MUNCY BANK FINANCIAL INC	PELICAN FINANCIAL INC
LEESPORT FINANCIAL CORP	NATIONAL PENN BANCSHARES	PENN COMMERCE BNCORP INC
LEGACY BANCORP INC	NBT BANCORP INC	PENN LAUREL FINANCIAL CP
LIBERTY BELL BANK	NEW MILLENNIUM BANK NJ	PENNROCK FINANCIAL SVCS
LONG ISLAND FINANCIAL	NEWALLIANCE BANCSHARES	PEOPLES FINANCIAL SVCS
LSB CORPORATION	NORTH FORK BANCORP	PEOPLES FNCL CORP MS
LUZERNE NATIONAL BANK	NORTHEAST BANCORP	POTOMAC BANCSHARES
LYNDONVILLE SAVINGS BANK	NORTHUMBERLAND BANCORP	PRIME BANK CT
LYONS BANCORP INC	NORTHWAY FINANCIAL INC	QNB CORP
M&T BANK CORP	NORTHWEST BANCORPORATION	RED OAK BANK
MAGYAR BANCORP INC	NORWOOD FINANCIAL CORP	REPUBLIC FIRST BNCP INC
MAINSTREET BANK	NSD BANCORP INC	RIVERGREEN BANK

Regional – Northeast Banks	Regional - Northeast Banks	Regional - Northeast Banks
ROCKPORT NATL BANC	STERLING FINANCIAL CP PA	USB HOLDING CO INC
ROCKVILLE FINANCIAL INC	STEWARDSHIP FINANCIAL CP	VALLEY NATIONAL BANCORP
ROYAL BANCSHARES PA CL A	SUFFOLK BANKCORP	VERNON BANK CORP
RUMSON-FAIR HAVEN BK &TR	SUN BANCORP INC	VSB BANCORP INC NY
S&T BANCORP INC	SUNCOAST BANCORP	WAINWRIGHT BANK & TRUST
SBT BANCORP INC	SUSQUEHANNA BANCSHARES	WASHINGTON TRUST BANCORP
SERVICE BANCORP	SUSSEX BANCORP	WAWEL SAVINGS BANK (NJ)
SHORE COMMUNITY BANK	SVB FINANCIAL SERVICES	WEST MILTON BANCORP
SIGNATURE BANK	TARPON COAST BANC	WESTBANK CORP
SLADE'S FERRY BANCORP	TOMPKINS TRUSTCO INC	WILBER CORP
SMITHTOWN BANCORP	TOWER BANCORP	WILTON BANK (CT)
SOMERSET HILLS BANCORP	TOWN BANK,THE NJ	WOODLANDS FINANCIAL SVC
SOUTHEASTERN BANK	TRUSTCO BANK CORP NY	YARDVILLE NATIONAL BNCP
SOUTHERN CONNECTICUT BNC	TWO RIVER COMMUNITY BANK	
STAMFORD BANK NY	UNION BANKSHARES CO	
STATE BANCORP INC	UNION BANKSHARES INC VT	
STATE STREET CORP	UNION NATIONAL FINL	
STERLING BANCORP	UNITY BANCORP	
STERLING BANK NJ	UNIVEST CORP PA	

Regional - Mid-Atlantic Banks	Regional - Mid-Atlantic Banks	Regional - Mid-Atlantic Banks
ABIGAIL ADAMS NATL BANCP	BANK OF WILMINGTON CORP	CENTRAL FLORIDA ST BANK
ALBEMARLE FIRST BANK	BANKGREENVILLE FINANCIAL	CENTRAL VIRGINIA BANKSHR
AMERICAN BANK HOLDINGS	BAY BANKS OF VA	CHEROKEE BANKING COMPANY
AMERICAN COMMUNITY BCSH	BAY NATIONAL CORP	CITIZENS & NORTHERN CORP
AMERICAN NATL BNKSHRS VA	BB&T CORP	CITIZENS BANCORP OF VA
AMERIS BANCORP	BENCHMARK BANKSHARES INC	CITIZENS BNCSHRS CORP GA
ANNAPOLIS BANCORP INC	BNC BANCORP NC	CITIZENS COMMUNITY BK VA
ATLANTIC LIBERTY FNCL	BOE FINANCIAL SVCS OF VA	CITIZENS FINANCIAL WV
BANCORP BANK, THE	BURKE & HERBERT BK	CITY HOLDING CO (WV)
BANCORP INCORPORATED	BV FINANCIAL INC	CN BANCORP INC
BANCSHARES OF FLORIDA	C&F FINANCIAL CORP	COAST FINANCIAL HLDGS
BANK OF CAROLINAS	CALVIN B TAYLOR	COASTAL BANKING CO INC
BANK OF COMMERCE NC	CAPITAL BANK CORP NC	COLONIAL VIRGINIA BANK
BANK OF GRANITE CORP	CAPITAL CITY BANK GROUP	COLONY BANKCORP INC
BANK OF MCKENNEY VA	CARDINAL BANKSHARES	COLUMBIA BANCORP MD
BANK OF OAK RIDGE	CARDINAL STATE BANK	COMMERCEFIRST BANCORP MD
BANK OF RICHMOND N.A.THE	CAROLINA BANK HOLDINGS	COMMERCIAL BANKSHARES FL
BANK OF SOUTH CAROLINA	CAROLINA NATIONAL CORP	COMMONWEALTH BANKSHS VA
BANK OF THE JAMES FNL GP	CAROLINA TRUST BANK	COMMUNITY BANKERS CORP
BANK OF VA CHESTERFIELD	CARROLLTON BANCORP	COMMUNITY BANKSHARES SC

Regional – Mid-Atlantic Banks	Regional - Mid-Atlantic Banks	Regional - Mid-Atlantic Banks
COMMUNITY BK NORTHERN VA	FIRST CHARTER CORP	GATEWAY FINANCIAL HLDGS
COMMUNITY CAP BCSHS	FIRST CITIZENS BANCSHR A	GB&T BANCSHARES
COMMUNITY CAPITAL CORP	FIRST CITIZENS BNCRP SC	GEORGIA BANCSHARES INC A
COMMUNITY FNCL CORP VA	FIRST COMM BNK OF GA	GEORGIA CAROLINA BKSHS
COMMUNITYSOUTH BANCSHARE	FIRST COMMRCE COMM BKSHR	GLEN BURNIE BANCORP
COUNTY FIRST BANK MD	FIRST COMMUN BNCSHRS VA	GREAT PEE DEE BANCORP
COWLITZ BANCORPORATION	FIRST COWETA BANK GA	GREENVILLE FIRST BANCSHA
DELMAR BANCORP	FIRST MARINER BANCORP	GUARANTY BANCSHARES INC
EAGLE BANCORP INC	FIRST NATIONAL CORP VA	HABERSHAM BANCORP
EAGLE FINANCIAL SERVICES	FIRST NATL BANCSHARES SC	HAMPTON ROADS BANKSHARES
EASTON BANCORP INC MD	FIRST NATL BANKSHARES FL	HARFORD BANK ABERDEEN MD
EBANK FINANCIAL SERVICES	FIRST REL BNCSHRS INC SC	HCSB FINANCIAL CORP
ECB BANCORP INC	FIRST TRUST BANK NC	HIGHLANDS BANKSHARES VA
F & M BANK CORP	FIRST UNITED CORP	HIGHLANDS BANKSHARES WV
FARMERS & MERCHANTS BANK	FIRST WEST VA BANCORP	IDAHO BANCORP ID
FIDELITY BANKSHARES INC	FIRSTBANK FINANCIAL SERV	INDEPENDENCE FED SAV BK
FINANCIAL INSTITUTIONS	FLORIDA COMMUNITY BANKS	INTEGRITY FNCL CORP
FIRST BANCORP NC	FNB CORP (NC)	JACKSONVILLE BANCORP
FIRST BANK OF DELAWARE	FNB FINANCIAL SERVICE NC	LCNB CORP
FIRST CAPITAL BANCORP GA	FREEDOM BANK OF VIRGINIA	LSB BANCSHARES NC

Regional - Mid-Atlantic Banks	Regional - Mid-Atlantic Banks	Regional - Mid-Atlantic Banks
MAIN STREET BANKS INC	PARKWAY BANK	SNB BANCSHARES INC TX
MBNA CORP	PENNS WOODS BANCORP INC	SOUND BANKING CO
MERCANTILE BANKSHARES CP	PEOPLES BANCORP OF NC	SOUTH FINANCIAL GROUP
MIDCAROLINA FINANCIAL	PEOPLES BANCORP SC	SOUTHEASTERN BANK FIN'L
MIDDLEBURG FINANCIAL COR	PIEDMONT CMNTY BK GA	SOUTHERN CMMTY BNCSHS GA
MILLENNIUM BANKSHARES CP	PIONEER BANKSHARES INC	SOUTHERN CMMTY FNCL CORP
MONARCH BANK	POTOMAC BANK OF VIRGINIA	SOUTHSIDE BANCSHARES INC
MONROE BANCORP	PREMIER COMMUNITY BNKSHS	SOUTHWEST GA FIN CORP
MOUNTAIN 1ST BNK & TR NC	PROVIDENT BANKSHARES CP	STERLINGSOUTH BANK & TR
MUTUAL COMMUNITY SAVINGS	RIGGS NATIONAL CORP	SUFFOLKFIRST BANK
NATIONAL BANKSHARES INC	RISING SUN BANCORP MD	SUMMIT BANK CORPORATION
NEW CENTURY BANCORP NC	RIVER CITY BANK	SUMMIT FINANCIAL CORP
NEW COMMERCE BANCORP	ROEBLING FINANCIAL CORP	SUMMIT FNCL GROUP INC
NORTH STATE BANCORP	SANDY SPRING BANCORP	SUNAMERICAN BANCORP
NORTH VALLEY BANCORP	SAVANNAH BANCORP INC	SURREY BANCORP NC
OLD HARBOR BANK (FL)	SCBT FINANCIAL CORP	SYNOVUS FINANCIAL CORP
OLD LINE BANCSHARES MD	SCOTTISH BANK (THE)	TIB FINANCIAL CORP
OLD POINT FINANCIAL	SEACOAST BANKING CORP FL	TOWNE BANK VA
OPTIMUMBANK HOLDINGS, IN	SHORE BANCSHARES INC	TRANSCOMMUNITY FINANCIAL
PAB BANKSHARES INC	SHORE FINANCIAL CORP	TRI COUNTY FINANCIAL GRP

Regional - Mid-Atlantic Banks
TRINITY BANK NC
TRISTONE COMMUNITY BANK
UNION BANKSHARES CORP
UNION COMMUNITY BANCORP
UNITED BANKSHARES INC WV
UNITED COMMUNITY BANKS
UNITED FINANCIAL BKG COS
UNITED FINANCIAL INC
VILLAGE BANK & TRUST FIN
VIRGINIA COMMRC BANCORP
VIRGINIA FINANCIAL GROUP
VIRGINIA NATIONAL BANK
WACCAMAW BANCSHARES INC
WESBANCO INC
WESTSTAR FINCL SCV CORP
WGNB CORPORATION
WILMINGTON TRUST CORP
WSFS FINANCIAL CORP
YADKIN VALLEY BK & TR CO

Regional - **Southeast Banks**	Regional - **Southeast Banks**	Regional - **Southeast Banks**
ALABAMA NATIONAL BANCORP	COMMUNITY BANCSHARES INC	FNB CORPORATION VA
AMSOUTH BANCORPORATION	COMMUNITY FIRST BNCP SC	FOUR OAKS FINCORP
APPALACHIAN BANCSHARES	COMMUNITY FRST FNCL CORP	FPB BANCORP INC
ATLANTIC SOURTHERN FINCL	COMMUNITY NATL BANCORP	FREEDOM BANK BRADENTON
AUBURN NATIONAL BANC INC	COMMUNITY TRUST BNCP INC	GBC BANCORP INC
BANC CORPORATION	COMPASS BANCSHARES INC	GLOBE BANCORP INC
BANCORPSOUTH INC	CORNERSTONE BANCSHARES	HANCOCK HOLDING CO
BANCTRUST FINANCIAL GRP	CRESCENT BANKING COMPANY	HERITAGE BANKSHARES VA
BANK OF THE OZARKS INC	EASTERN VIRGINIA BNKSHRS	HERITAGE FINANCIAL GROUP
BEACH COMMUNITY BANC INC	FARMERS CAPITAL BANK CP	HIBERNIA CORP A
BEACH FIRST NATL BNKSHRS	FAUQUIER BANKSHARES INC	HORIZON BANCORPORATION
BRITTON & KOONTZ CAP CP	FIRST BANCSHARES INC MS	IBERIABANK CORPORATION
CAPITAL BANCORP INC	FIRST CAPITAL BANK	METAIRIE BANK & TRUST LA
CAPITALSOUTH BANCORP	FIRST COMMUNITY BK CORP	MIDSOUTH BANCORP INC
CARDINAL FINANCIAL CORP	FIRST FINANCIAL SVC CORP	MINDEN BANCORP INC
CENTERSTATE BANKS OF FL	FIRST HORIZON NATIONAL	MOUNTAIN NATIONAL BANC
CITIZENS FIRST CORP	FIRST M & F CORPORATION	NATURE COAST BANK CRY RV
CITIZENS NATIONAL CORP	FIRST NATL BANCSHARES	NB&T FINANCIAL GROUP
CIVITAS BANKGROUP INC	FIRST SECURITY BANCORP	NBC CAPITAL CORPORATION
COLONIAL BANCGROUP CL A	FNB CORPORATION FL	NEXITY FINANCIAL CORP

Regional - Southeast Banks
PARAGON NATIONAL BANK
PENSECO FINL SVCS CORP
PEOPLES BANCTRUST CO
PINNACLE BANCSHARES CORP
PINNACLE FINANCIAL PARTN
PREMIER FINANCIAL BANCP
REGIONS FINANCIAL CORP
RENASANT CORP
REPUBLIC BANCORP INC CLA
S.Y. BANCORP INC
SECURITY BANK CORP
SIMMONS FIRST NATL CORP
SOUTHCOAST FNCL CORP
SOUTHSHORE COMMUNITY BK
STONEGATE BANK FL
TENNESSEE COMMERCE BANC
TRUSTMARK CORP
UNITED BANCORP OF AL A
UNITED SECURITY BANCSHR
WHITNEY HOLDING CORP

Regional - Midwest Banks	Regional - Midwest Banks	Regional - Midwest Banks
ILLINI CORPORATION	NORTHERN STATES FIN CP	RIDGESTONE FNL SERV INC
INDEPENDENT BANK CORP MI	NORTHERN TRUST CORP	SKY FINANCIAL GROUP INC
INTEGRA BANK CORPORATION	OAK FINANCIAL CORP	SOUTHERN MICHIGAN BNCRP
IRWIN FINANCIAL CORP	OAK HILL FINANCIAL INC	ST JOSEPH CAPITAL CORP
KILLBUCK BANCSHARES	OHIO STATE BANCSHARES	STATE FINANCIAL SVCS
LAKELAND FINANCIAL CORP	OHIO VALLEY BANC CORP	STURGIS BANCORP INC
LNB BANCORP	OLD NATIONAL BANCORP IN	TAYLOR CAPITAL GROUP
MACATAWA BANK CORP	OLD SECOND BANCORP INC	TOWER FINANCIAL
MAIN STREET TRUST INC	OTTAWA SAVINGS BANCORP	TOWN & COUNTRY FINANCIAL
MAINSOURCE FINANCIAL GRP	OXFORD BANK	TRI-STATE FIRST BANC OH
MARSHALL & ILSLEY CORP	PARK NATIONAL CORP	UNIONBANCORP INC
MERCANTILE BANCORP	PAVILION BANCORP INC MI	UNITED BANCORP INC MI
MERCANTILE BANK CORP MI	PEOPLES BANCORP INC OH	UNITED BANCORP INC OH
MERCHANTS & MANUFAC BNC	PEOPLES COMMUNITY BNCRP	UNITED COMMERCE BANCORP
MID WISCONSIN FNCL SRVS	PFS BANCORP INC	UNIVERSITY BANCORP INC
MID-SOUTHERN SAVINGS BK	PRINCETON NATL BANCORP	UNIZAN FINANCIAL CORP
MIDWEST BANC HOLDNGS INC	PRIVATEBANCORP INC	US BANCORP
MONARCH COMMUNITY BANCRP	PSB GROUP INC	WEST POINTE BANCORP INC
NATIONAL CITY CORP	PSB HOLDINGS INC /WI/	WINTRUST FINANCIAL CORP
NORTHERN STAR FINL	REPUBLIC BANCORP INC	

Regional - Midwest Banks	Regional - Midwest Banks	Regional - Midwest Banks
1ST SOURCE CORP	COMMERCIAL NATL FINL CP	FIRST FINANCIAL CORP IN
AF FINANCIAL GROUP INC	COMMERCIAL NATL FNCL MI	FIRST FINANCL BANCORP OH
AJS BANCORP INC	COMMUNITY BUSINESS BANK	FIRST INTERNET BANCORP
AMCORE FINANCIAL INC	CORTLAND BANCORP	FIRST MANITOWOC BANCORP
AMERICAN COMMUNITY BNCRP	CORUS BANKSHARES INC	FIRST MERCHANTS CORP
ASSOCIATED BANC-CORP	CROGHAN BANCSHARES	FIRST MID ILLINOIS BNCSH
BARABOO BANCORP	CSB BANCORP	FIRST MIDWEST BANCORP
BAYLAKE CORPORATION	DCB FINANCIAL CORP	FIRST OAK BROOK BNCSHRS
BELMONT BANCORP	DEARBORN BANCORP INC	FIRST PLACE FINCL CORP
CAPITAL DIRECTIONS INC	DENMARK BANCSHARES INC	FIRSTBANK CORP MICHIGAN
CAPITOL BANCORP LTD	DSA FINANCIAL CORP	FIRSTMERIT CORP
CHEMICAL FINANCIAL CORP	EXCHANGE BANCSHARES INC	FNB INC
CHOICEONE FINANCIAL SVCS	FARMERS NATIONAL BANCORP	FNBH BANCORP INC MI
CITIZENS BANKING CORP	FC BANC CORP	FUTURA BANC CORP
CITIZENS COMM BANCORP WI	FENTURA FINANCIAL INC	GERMAN AMERICAN BANCORP
CITY SVNGS FNCL-INDIANA	FIFTH THIRD BANCORP	HCB FINANCIAL CORP
CLOVER LEAF FINANCIAL	FIRST BANKING CENTER WIS	HEARTLAND BANCORP
CNB CORPORATION (MI)	FIRST BUSEY CORP CL A	HEARTLAND BANCSHARES INC
COMERICA INC	FIRST BUSINESS FINL SRVS	HUNTINGTON BANCSHARES
COMMERCIAL BANCSHARES	FIRST FED NORTH MICH BAN	ICNB FINANCIAL CORP

Regional - Pacific Banks	Regional - Pacific Banks	Regional - Pacific Banks
1ST CENTURY BANK NA (CA)	BORREGO SPRINGS BK	CHARTER OAK BANK (CA)
ALBINA COMMUNITY BANCORP	BRIDGE CAPITAL HOLDINGS	CHEMUNG FINANCIAL CORP
ALLIANCE BANCSHARES CA	BRUNSWICK BANCORP	CHINO COMMERCIAL BANK NA
AMERICAN BUSINESS BK CA	BUSINESS BANK	CITIZENS BANCORP CA
AMERICAN RIVER BANKSHRS	BWC FINANCIAL CORP	CITY BANK
AMERICANWEST BANCORP	CALIFORNIA CMMTY BANK	CITY NATIONAL CORP
BAKER BOYER BANCORP	CALIFORNIA OAKS STATE BK	COAST BANCORP
BANK HOLDINGS INC, THE	CALIFORNIA UNITED BANK	COLUMBIA BANCORP OREGON
BANK OF AMADOR	CALNET BUSINESS BANK	COLUMBIA COMMERCIAL BANC
BANK OF COMMERCE HLDG CA	CALWEST BANCORP	COMBANC
BANK OF HAWAII CORP	CANYON NATIONAL BANK CA	COMMERCEWEST BANK CA
BANK OF MARIN	CAPITAL CORP OF THE WEST	COMMONWEALTH BUSINESS BK
BANK OF SALEM	CAPITAL PACIFIC BANK	COMMUNITY BANCORP INC CA
BANK OF SANTA CLARITA CA	CASCADE BANCORP	COMMUNITY BANCORP NV
BANK ON IT INC	CASCADE FINANCIAL CORP	COMMUNITY BANK OF BAY
BAY COMMERCIAL BANK (CA)	CATHAY GENERAL BANCORP	COMMUNITY BK SANTA MARIA
BEACH BUSINESS BANK	CENTRAL COAST BANCORP	COMMUNITY CENTRAL BANK
BEO BANCORP (OR)	CENTRAL PACIFIC FNCL	COMMUNITY VALLEY BANCORP
BLUE VALLEY BAN CORP KS	CENTRAL VALL CMMMTY BNCP	COMMUNITY WEST BANCSHRS
BNCCORP INC	CENTURY BANK	CORONADO FIRST BANK

Regional - Pacific Banks	Regional - Pacific Banks	Regional - Pacific Banks
COUNTY BANK CORPORATION	FIRST PAC TRUST BANCORP	HERITAGE COMMERCE CORP
COUNTY COMMERCE BANK CA	FIRST PACIFIC BANK SD CA	HERITAGE OAKS BANCORP
CVB FINANCIAL CORP	FIRST REGIONAL BANCORP	ICB FINANCIAL CA
DESERT COMMERCIAL BANK	FIRST SOUND BANK (WA)	LANDMARK NATIONAL BK CA
DESERT COMMUNITY BANK	FIRST STANDARD BANK	LEGACY BANK N.A.
DIABLO VALLEY BANK	FIRST VIETNAMESE AMER BK	M & F BANCORP
DISCOVERY BANK CA	FNB BANCORP CALIFORNIA	MALAGA FINANCIAL CORP
DNB FINANCIAL CORP	FOOTHILL INDEPENDT BANCP	MECHANICS BANK
EAST WEST BANCORP INC	FOUNDERS COMMUNITY BANK	MERCHANTS BANCORP OR
EPIC BANCORP	FREMONT GENERAL CORP	METROPACIFIC BANK
EXCHANGE BANK	FRESNO FIRST BANK	MID-STATE BANCSHARES
FARMERS & MERCH LONG BCH	FRONTIER FINANCIAL CORP	MID-VALLEY BANK OREGON
FARMERS & MERCHANTS BNCP	GLACIER BANCORP INC	MIRAE BANK
FARMERS & MERCHANTS BNSH	GOLDEN STATE BUSINESS BK	MISSION BANCORP
FIRST AMER BANK ROSEMEAD	GRANITE COMMUNITY BANK	MISSION COMMUNITY BANCP
FIRST CITIZENS BANC CORP	GRANITE STATE BANK CA	MISSION OAKS BANCORP
FIRST COMMRCE BANCORP CA	GREAT BASIN FINANCIAL	MISSION VALLEY BANCORP
FIRST COMMUNITY BNCP CA	GREATER BAY BANCORP	MNB HOLDINGS CORP
FIRST MOUNTAIN BANK CA	GREATER SACRAMENTO BNCRP	MOTHER LODE BK SONORA CA
FIRST MUTUAL BANCSHARES	HANMI FINANCIAL CORP	MOUNTAIN BANK HLDG CO WA

Appendix 5 – Some key aspects of the capital requirement regulation

The capital requirement regulation sets a framework on how banks and depository institutions must handle their capital in relation to their assets.

Internationally, the Bank for International Settlements's Basel Committee on Banking Supervision influences each country's capital requirements. In 1988, the Committee decided to introduce a capital measurement system commonly referred to as the Basel Capital Accords (Basle I). The latest capital adequacy framework is commonly known as Basel II.

The Basle I – The Basle Capital Accord

The Basle I is the original accord to come from the Basel Committee, which ensures that financial institutions retain enough capital to protect themselves against unexpected losses from the banks assets.

Banks should have adequate capital because capital serves as a financial shield to enable a bank to drive out earnings volatility (instability). The greater the potential for earnings volatility (i.e. riskier) the more capital a bank should hold. Since capital is more costly than other sources of funds, banks have more incentives to choose a level of capital that may not be appropriate to the risks they take and this is the underlying concern addressed by risk based capital regulation. In accordance with Basle I, banks should not go below the minimum capital adequacy.

Basle I defined capital adequacy as a single number that is the ratio of a bank's capital to its assets. There are two types of capital:- tier one and tier two. The first is primarily core share capital and disclosed reserves and excludes preferred stock. The second includes other types such as preference shares, undisclosed reserves, general loss reserves, and allowance for loan and lease losses and subordinated term debt. The key requirement was that total capital was at least 8% of assets.

Basle I calculated capital adequacy as follows:

Risk based capital adequacy = Capital / Risk Weighted Assets

(Note: Minimum tier one capital should not be less than 4% of risk weighted assets and minimum tier two capital should not be less than 1.25% of risk weighted assets).

or

Total risk based capital adequacy = total capital (tier one capital plus tier two capital less certain deductions) / total risk weighted assets

(Note: Total Risk based capital adequacy should not be less than 8%).

Risk weighted Assets

The risk-weighted assets are calculated by assigning each asset and off-balance-sheet item to one of four broad risk categories. These categories are assigned risk weights of 0 percent, 20 percent, 50 percent, and 100 percent. Riskier assets are placed in the higher percentage categories. Very safe assets, such as government debt, have a zero weighting, high risk assets (such as unsecured loans) have a rating of 100%. Other assets have weightings somewhere in between. Commonwealth government securities with more than twelve months to maturity carry a 10 per cent risk weighting, as do state government securities. Claims on other banks, Australian local governments and public-sector organisations, other than those with corporate status or which operate commercially, carry a 20 per cent risk weighting. Loans secured by a mortgage over residential property and with a loan-to-valuation of 80 per cent or less carry a 50 per cent risk weighting and loans to companies or individuals carry a 100 per cent risk weighting.

The weighted value of an asset is its value multiplied by the weight for that type of asset.

The first Basle accord (Basle I) was issued on July 15, 1988 and sets out the basics - such as credit risk. This was updated in 1996 to cover market risk and to clarify and extend the first Accord. The first Basel 1 accord currently, remains as the key method of calculating the US bank capital adequacy. However, since 2007 the larger US banking corporations have commenced introducing the uncomplicated versions of Basle II capital adequacy regulation to calculate the banking corporation's capital adequacy. Therefore, currently, in the US the larger banks are producing two sets of capital adequacy calculations for the regulators, the first set calculated in accordance with Basle I regulations, and the second set computed in accordance with one of the simple versions of Basle II capital adequacy accord. Currently, Basle I is the main method used to determine capital adequacy in the US and other relevant countries in the world. It is important to note, even at this stage of the thesis that this research study has used the Basle I's risk weighted assets calculations to estimate one of the key elements that this study requires. Chapter 4, section 4.2.2.2 details how the risk weighted assets calculations were utilised to estimate the required element.

The new Basel Capital Accord - The Basel II

The Basel I accord is to be replaced, in stages, by new rules (Basel II), because Basel I was being regarded by many bank regulators as being crude and that it only accounted for credit risk and market risk, but Basle II enables enhanced risk monitoring by including operational risk and other risks. The second Basel Accord was finalized in 2004 after consulting extensively all members of the Basle committee. The Basle II accord is aimed at making the capital measures much more risk sensitive and itemizing and quantifying several more categories of risk.

The new Basel framework known as Basel II - will replace the existing Basel I framework fully in 2008. Since Basle II was completed in 2004 the regulators around the world have been preparing for its implementation.

The new framework (Basle II), is a non-binding agreement which has been in development since 1999 and it sets the standard for prudential regulation among the G-10 countries, although many other countries also seek to implement the framework.

The new Basel capital accord's provisions are given legal force by the national legislatures and regulatory bodies, which commit to change any necessary banking laws and regulatory practices in order to abide by the standards and guidelines and statements of best practice.

Basel II comprises three pillars:

- *Pillar 1: capital adequacy (minimum capital requirements).*

  This "pillar" is similar to the Basel 1 requirements. It will indicate whether banks have capital appropriate for their risk taking activities.

- *Pillar 2: supervisory disclosure (supervisory review process).*

  Under pillar 2 banks supervise themselves by properly assessing the risk that they are taking when carrying out their activities and they have to disclose the risk. Under pillar 2 the bank supervisory institutions have to evaluate the soundness of the assessments disclosed by the bank. The second pillar makes use of sophisticated risk models to complete the pillar 2 calculations. For example, computer packages under pillar 2 can ascertain whether additional capital (i.e. more than required by pillar 1) is necessary .

- *Pillar 3 : market discipline (market forces risk).*

  The third pillar requires banks to disclose pertinent information necessary to enable market mechanism to complement the supervisory oversight function. Therefore, more disclosure of capital risks and risk management policies is required under pillar 3. This encourages the markets to react to the taking of high risks.

The new framework will be more risk sensitive than Basel I, as Pillar 1 offers a menu of approaches of increasing sophistication for calculating credit and operational risk. This may give incentives to banks to improve their risk management practices by requiring them to hold appropriate regulatory capital as their risk management practices become more advanced.

The new framework also recognises for the first time the use of risk mitigation, such as collateralisation and credit derivatives, and introduces a choice of methods of calculating the regulatory capital required to be held against securitisation exposures.

Implementation of the Basel II framework for internationally active banks will pose problems of complexity and consistency for banks, that are active across international borders, if different jurisdictions apply the provisions of the Basel II framework in different ways, for even the differences in application are quite subtle.

The objective of the International Banking Federation (IBfeds)'s Basel II working party is to ensure the continuance of mutual recognition of Basle II between the major jurisdictions. The basic objective is to ensure that no institution will be subject to more than one interpretation of the new Accord in any jurisdiction because of home/host differences. To this end the industry strongly supports the development of a lead supervisory model. The lead (home state) supervisor would lead on the global supervision of a group and the approval process for the more advanced approaches. The host supervisor would lead on local implementation. The efforts of all would be coordinated in a college of supervisors.

The industry strongly supports the efforts of the Accord Implementation Group, a sub-group of the Basel Committee, to ensure convergence in practice, which it will achieve by monitoring the implementation timetables and methodologies of regulators around the world and by meeting, where appropriate, with international groupings of regulators such as the Accord Implementation Group (AIG).

All the calculations required by Basel II under pillars 1,2 and 3 are calculated by advanced computer packages. Unlike Basle 1, which has an optional risk reporting requirement, Basel II has a compulsory reporting requirement for all the risk management calculations, completed under pillars 1,2 and 3.

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