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競爭異質性軌跡之研究－動態資源構形模型(第 3 年)

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報 告 附 件 ：出席國際會議研究心得報告及發表論文

公 開 資 訊 ：本計畫涉及專利或其他智慧財產權，1 年後可公開查詢

中 華 民 國 102 年 10 月 30 日

中 文 摘 要 ： 策略管理相關研究主張，擁有競爭優勢的廠商長期之績效長期優於同業，許多文獻採用財務績效作為分析有無競爭優勢的有效指標。達到高於產業平均報酬率或擁有超額報酬率的廠商，被視為具有競爭優勢。然而，財務變數只反映單一會計年度之績效，因此必須長期觀察才能確定廠商是否擁有持續性競爭優勢。要多久及績效要多持續，才能被稱為持續性競爭優勢？在高度競爭的時代，能找到績效長期優於同業的廠商嗎？本研究運用潛在類別成長分析(LCGA)之羅吉斯模型，依據產業內廠商之績效軌跡分類為數群，依此找出 2000 年以後達到較優績效的廠商。本研究共分析三種類型之廠商：半導體製造業、電腦程式及資料處理服務業、以及遭遇財務困境之企業。所有樣本資料均擷取自 Compustat 北美版資料庫。實證研究結果如下：(1) LCGA 依據 2000-2012 年財務績效表現(高於或低於產業平均)的企業及其績，找出績效軌跡相異之廠商群組兩至三群(視所採用之財務指標而定)。(2)某一指標所分類之群組內廠商，與另一指標之分類結果不盡相同，由此可知，僅使用單一財務指標決定廠商是否具有競爭優勢，可能產生偏誤之結果。(3)失敗企業(指於研究期間內因破產而下市之公司) 之現金循環周期較其他企業更短，而成本佔銷售淨額比例較高。

中文關鍵詞： 持續性競爭優勢、財務績效、潛在類別成長分析、軌跡分析

英 文 摘 要 ： The strategic management studies suggest that firms with sustained competitive advantage outperform their rivals in the long time. It is widely accepted that the financial performance are effective evidences to detect the competitiveness of the firms. Firms that achieve above-average return or enjoy excess returns are encountered having competitive advantage. Since financial variables are merely the firm’s operational outcome in one fiscal year, the evidence of sustained competitive advantage must be reviewed in repeated measurements over a long time. How sustained the firm’s performance should present so as to be called sustainable? During the hypercompetition era, can we find the winners that perform superior to others over a long time? This research uses the latent class growing analysis (LCGA) to classify the trajectory of performance into groups. The firms that have achieved superior performance over the period after millennium are

identified. This research studies three types of industries: manufacturing (semiconductor) industry, services (computer programming and data processing) industry, and the firms in the dark side in the Internet industry. All sample companies are derived from the Compustat American database. The findings of the empirical study are as follows: (1) The LCGA identifies two to three groups of firms according to the achievement of superior financial performance (above industry average) and the trajectories over 13 years. (2) The firms classified in the group of superior performance by one financial variable are not all the same as those identified by other financial variables. This result implies that the results from using single financial variable to determine the existence of competitive advantage may be bias. (3) The failed firms, which is defined as those delisted from the market because of bankruptcy during 2000-2012, show faster annual growth rate and shorter cash-cycle period but suffer from higher cost to sales ratios.

英文關鍵詞： sustained competitive advantage, financial performance, latent class growth analysis, trajectory analysis

How Sustained is Sustainable?: The Trajectory of Competitive Advantage

Abstract

The strategic management studies suggest that firms with sustained competitive advantage outperform their rivals in the long time. It is widely accepted that the financial performance are effective evidences to detect the competitiveness of the firms. Firms that achieve above-average return or enjoy excess returns are encountered having competitive advantage. Since financial variables are merely the firm's operational outcome in one fiscal year, the evidence of sustained competitive advantage must be reviewed in repeated measurements over a long time. How sustained the firm's performance should present so as to be called sustainable? During the hypercompetition era, can we find the winners that perform superior to others over a long time? This research uses the latent class growing analysis (LCGA) to classify the trajectory of performance into groups. The firms that have achieved superior performance over the period after millennium are identified. This research studies three types of industries: manufacturing (semiconductor) industry, services (computer programming and data processing) industry, and the firms in the dark side in the Internet industry. All sample companies are derived from the Compustat American database. The findings of the empirical study are as follows: (1) The LCGA identifies two to three groups of firms according to the achievement of superior financial performance (above industry average) and the trajectories over 13 years. (2) The firms classified in the group of superior performance by one financial variable are not all the same as those identified by other financial variables. This result implies that the results from using single financial variable to determine the existence of competitive advantage may be bias. (3) The failed firms, which is defined as those delisted from the market because of bankruptcy during 2000-2012, show faster annual growth rate and shorter cash-cycle period but suffer from higher cost to sales ratios.

Keywords: sustained competitive advantage, financial performance, latent class growth analysis, trajectory analysis

How Sustained is Sustainable?: The Trajectory of Competitive Advantage

1. INTRODUCTION

> *There is no way to predict the price of stocks and bonds over the next few days or weeks. But it is quite possible to foresee the broad course of these prices over longer periods, such as the next three to five years. These surprising and contradictory finding, were made and analyzed by the 2013 Laureates, Eugene Fama, Lars Peter Hansen and Robert Shiller.*
>
> ~The Royal Swedish Academy of Sciences

Sustainability of competitive advantage is a central issue to strategic management (Barney, 1991; Porter, 1985; Schendel, 1994). It is widely accepted to define sustainable competitive advantage as firms' superior performance over the long run (e.g., Barney, 2001; Ghemawat and Rivkin, 1999, Peteraf, 1993). Scholars also recognize that firms with superior performance may or may not indicate the competitive advantage but merely luckiness (Levinthal, 1991; Barney, 1997). Hence, the relationship between firm performance and its competitive advantage is not deterministic but probabilistic. That is, firms generating excess profits or with above-industry average returns are not deemed to have competitive advantage, they are most probably to have competitive advantage (Powell, 2001; 2002; 2003; Tang and Liou, 2010). The inferences of competitive advantage are more or less static comparative since they are either time invariant or no specific time period.

There are studies study the movement of firm performance to examine the random effect of the firms' financial performance (Denrell, 2004; Denrell, Fang, and Zhao, 2012; Henderson, Raynor, Ahmed, 2013). The main efforts of these studies are to identify whether it is the firm's ability or luckiness to drive the superior performance. The aim of this research is not to test the randomness of the firms' performance but to explore the trajectory of them. The reasoning of this approach is as follows. The performance of the firm may present random walk effect, however, if the firm show superior trajectory of the performance in the industry for a long time, the firm most likely has identical capability instead of luckiness (Denrell, Fang, and Zhao, 2012).

What is the trajectory of the firm performance? The first factor depends on how this firm has performed in the long time. The annual financial performances of most firms are not steadily increasing or decreasing but are fluctuated over time. Therefore,

the recognition of outperformers is more complicated in the longitudinal time span than it is in the cross-section scenario. For example, suppose there are two competitive firms, A and B, both of which achieved superior performance to others in all years of the past ten years. We recognize that both of the firms have competitive advantage. If, however, both firms have only achieved superior performance six times during the past ten years. Firm A achieved superior performance from years 5 to 10 and Firm B achieved it from years 1 to 6. Apparently, we will denote that Firm A is more competitive than Firm B since Firm B had been in a downward trend while Firm A is in an upward trend during the same period. Therefore, to recognize whether a firm is more competitive than others in the long time not only depend on the frequency of the outperformance but also the trajectory of the firm's comparative performance relative to other firms.

The second factor is the variable selected to indicate superior performance. There are a number of financial variables commonly used to indicate the firm performance. These variables may not lead to the same conclusion about which firms outperform the industry average. For example, from 2003 to 2012, Google had outperformed Yahoo and the industry averages in all the 11 years on three financial indicators including return on total assets (ROA), profit margin (PM, which measures the net income received from per dollar sale), and earnings per share (EPS, before dilution and extraordinary items). For market-based indicators including market-to-book (MB) ratio and price-earnings (PE) ratio, Google performed superior to the industry averages in eight years out of the nine years from 2004, when the company went public, to 2012. Finally, for return on equity (ROE) and return on invested capital (ROIC), the company moved steadily over the 11 years while the industry averages showed much more volatile. For these two financial performance indicators, Google respectively performed superior to the industry averages for eight and seven times. In summary, Google, the company that has shown strong competitive advantage after millennium, are superior to the industry averages for 65-100 percent of the performing period for all the selected indicators. Yahoo, another internet services company that had fast growing path after millennium, outperformed the industry average on ROA and PM over the 13 years from 2000 to 2012. However, in terms of ROIC, ROE and MB ratio, this company showed superior performance for only one third to half of the performing period. The trajectory of performance indicates Google's outstanding performance over the long time period.

Although the factors that drive the performance differ, firms with an outperforming trajectory in the long time shall more or less indicate the presence or non-presence of sustained competitive advantage. Trajectory analysis assumes heterogeneity in a sample where unobserved homogeneous sub-populations exist

(Nagin, 1999). This research uses the latent class growth analysis (LCGA) to distinguish the group of firms with sustained performance from others. LCGA is a methodology that is developed by Nagin and Land (1993) in criminology and is widely used in other social disciplines for longitudinal data (Bushway and Weisburd, 2006). A lot of studies has presented the usefulness of this methodology for identifying a set of trajectory for homogeneous subpopulations within the larger heterogeneous population and for the identification of meaningful groups or classes of individuals in social studies (e.g., Barban and Billari, 2012; Sturgis and Sullivan, 2008; Syed and Seiffge-Krenke, 2013; Van den Akker et al., 2013).

This research applies the LCGA to three sectors: semiconductor (SIC=3674), which is a manufacturing industry; computer-based services industries including computer programming and data process (SIC=7370 and 7371), prepackaged software (SIC=7372), computer integrated system design (SIC=7373), computer processing and data preparation services (SIC=7374), and computer rental and leasing (SIC=7377); and the fast growing businesses (SIC codes= 7370, 7372, 7373). The results show that the LCGA is useful for identifying the trajectory of financial performance and the winners club in the specific industry. However firms classified in the winners' group by one financial indicator might be classified into other groups by different indicators. Therefore, it is questionable to determine a firm's status of competitive advantage or competitive disadvantage by only one or two randomly selected financial indicator.

Winners are defined as the firms that are classified in the group that achieved the most superior performance in all the seven selected financial indicators.

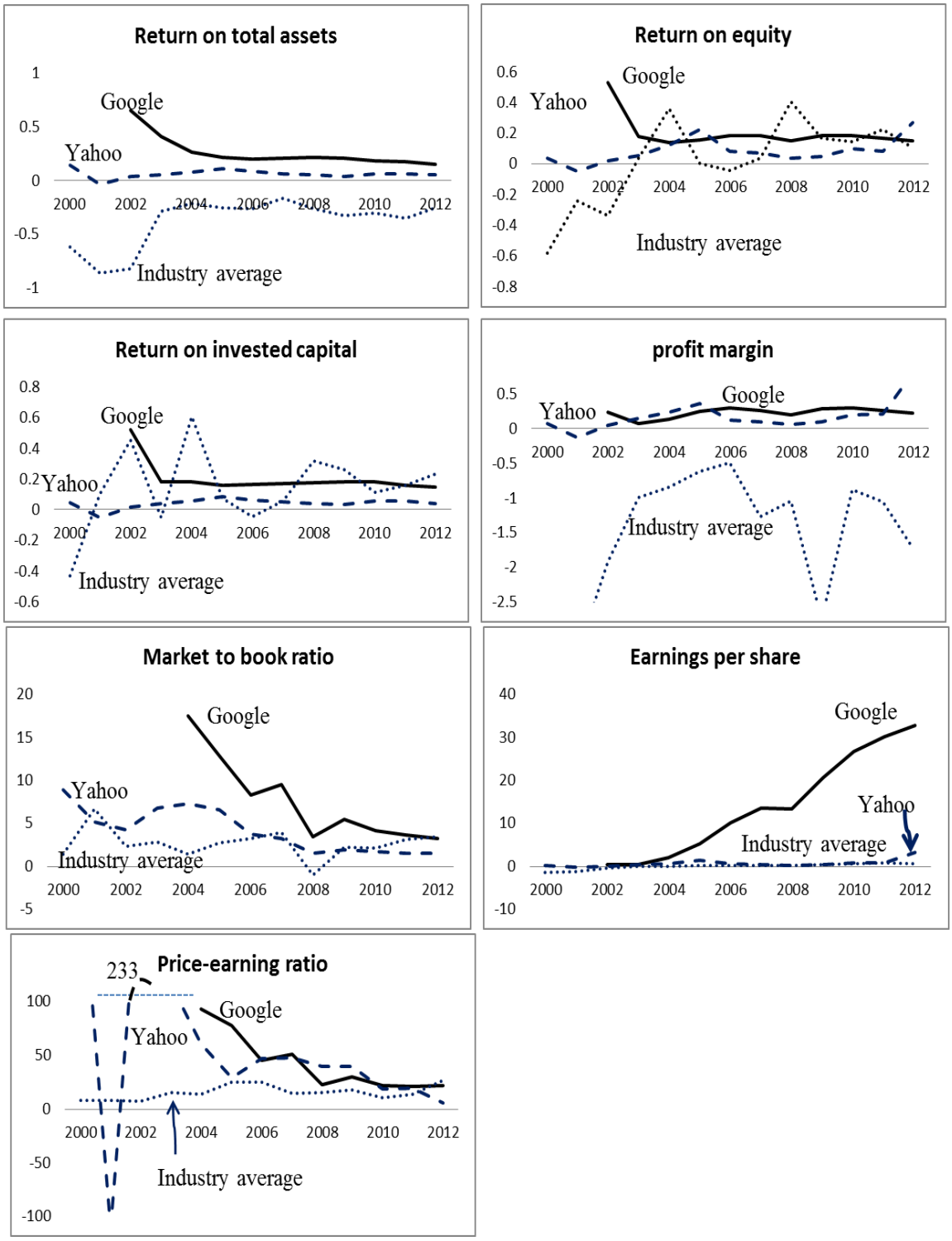


Figure 1-1 Google's financial performance comparative to Yahoo and industrial averages

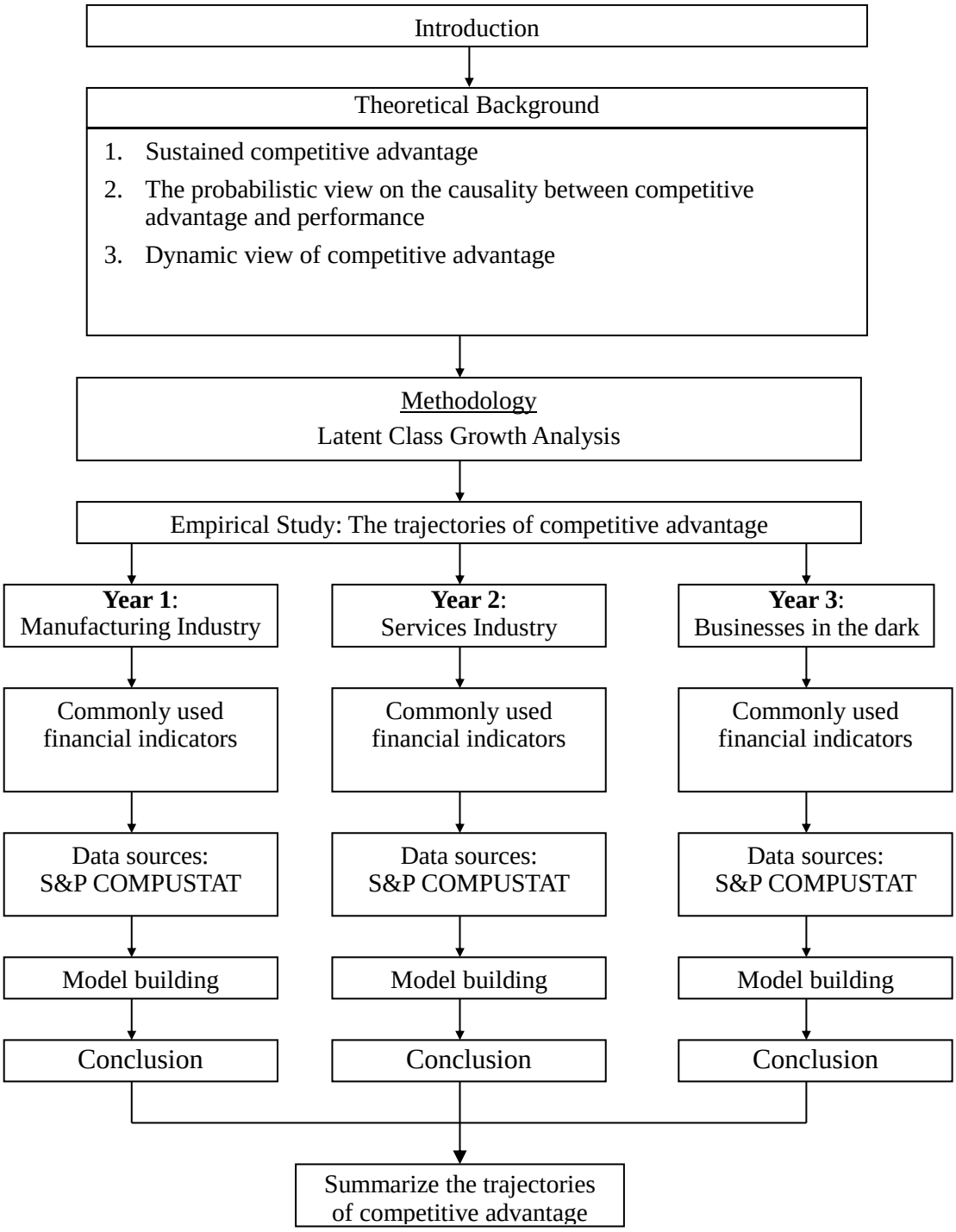


Figure 1-2 The Research Framework

2. THEORETICAL BACKGROUND

The core of the strategic management research is competitive advantage. The strategic management research can be grouped into two major schools according to the propositions on the sources of competitive advantage: the industry-based strategy (structure-conduct-performance school) and the resource-based view. The industry-based theory of strategy focuses on external factor (especially market structure). This school is represented by Porter (1980; 1985), who turns industrial-organization economics upside down (Barney and Ouchi, 1986: p.374). That is, Porter forms his normative competitive advantage on what neoclassical industrial-organization economics undesired or against. This school suggests that firms choose the industries in which to compete and/or altering the structure of chosen industries to increase monopoly power. Porter's (1980) five-force framework argues that the profitability of a firm in an industry is determined by (1) the threat of new entrants to the industry, (2) the threat of substitute products or services, (3) the bargaining power of its suppliers, (4) the bargaining power of its customers, and (5) the intensity of rivalry among its existing competitors. The strategy of the firm aims at choosing the best industries (usually those are highly concentrated) and/or altering the structure of the selected industry structure by raising barriers to entry and increase its bargaining power over suppliers and customers (Buzzell, Gale & Sultan, 1975; Miller, 1986; Miller & Freisen, 1986; Smith, Guthrie, & Chen, 1989). After choosing industries or altering their structures, Porter (1985) advocates choosing one of the three strategies: cost leadership, differentiation or focus. Subsequently, internal factors come in. Porter (1985) suggests firms implement its strategy by managing well the activities in its value chain because the basic unit of competitive advantage is the discrete activity (Porter, 1991: p. 102). Activities in the value chain are categorized as either primary or support. Primary activities include inbound logistics, operations, outbound logistics, marketing and sales. Support activities include procurement, technology development concerning the improvement of product and process, human resource management, and firm infrastructure (e.g., general management, planning, and finance).

Empirical studies show that highly concentrated industries are no more profitable than their less concentrated counterparts (Buzzell, Gale and Sultan, 1975; Gale and Branch, 1982; Ravenscraft, 1983). In addition, there are studies showing that the industry market share-profitability relationship is spurious (Jacobson and Aaker, 1985; Jacobson, 1988). Many theorists question the focus on external factors of industry-based theory. The resource-based theorists argue for the primacy of heterogeneous and imperfectly mobile resources. The RBV theory can trace to Penrose (1959), who view the firm as a collection of resources. The heterogeneous

resources bring the uniqueness of the firm. The RBV holds the argument that resources are both significantly heterogeneous across firm and imperfectly mobile (Lippman and Rumelt, 1982; Rumelt, 1984; Wernerfelt, 1984; Barney, 1991; 1992; Conner, 1991). To achieve competitive advantage or intern, superior financial performance, firms should seek resources that are valuable, rare, imperfectly mobile, inimitable, and nonsubstitutable (VRIN).

2.1 The Probabilistic View of the Causality between Competitive Advantage and Performance

Aiming at developing tools capable of prescribing a particular course of action for practitioners, mainstream of strategic management deploys inductive logic to infer principles, theoretical claims, and/or "takeaway" from particular cases and other empirical evidence. However, the popularity of this approach does not ensure that the generalizations procured from induction are universally tested or even broadly supported. Porter's (1980; 1985) proposition of generic competitive strategies and the VRIO (value, rare, imitable, and organization) argument (Barney, 1997) of the resource-based view (RBV) are indicated individually as a *truism* or *tautology* for they are not empirically falsifiable (Priem and Butler, 2001a; 2001b; Tang and Liou, 2010).

Powell (2001: 881) disputed the RBV by proposing the counterfactual condition of *competitive disadvantage*. He suggested transforming the deterministic, unidirectional proposition *sustainable competitive advantages create sustained superior performance* into a probabilistic inference: *sustainable competitive advantage is more probable in firms that have already achieved sustained superior performance*. Following the Bayesian process, which periodically updates its propositions or hypotheses in the face of empirical evidence, Powell laid out a syllogistic structure describing the relationships between competitive advantage, competitive disadvantage, and superior performance.

Similar to Powell's (2001) Bayesian process, Tang and Liou (2010) added an auxiliary or bridge hypothesis to help define the causal relationship between sustainable competitive advantage and sustainable superior performance. They indicated that the firm's unique configuration of resources (Miller, 1986; Siggelkow, 2002) that mediates between heterogeneous sources and competitive advantages, creating superior performance. Any primary sources of competitive advantage (a unique business process such as lean production, customer relationships, etc.) are considered embedded in and inseparable from the organization itself, along with its business units and functional departments. The RBV assumes that the process of managing these resource bundles, variously termed configuration, strategic fit

(Siggelkow, 2001; Levinthal, 1997), or causal ambiguity (Reed and DeFillippi, 1990; Rivkin, 2001), cannot be comprehended or imitated by outsiders. Yet, Tang and Liou suggested that we can infer the sources of the competitive advantage by decomposing the realized superior performance indicators such as operating revenue, market share, stock prices, and 10-K reports, which can be thoroughly assessed by the public.

Tang and Liou (2010) use the Bayesian conditional equation (1) to rationalize the causal relationship between sustained competitive advantage and the performance.

$$P(\boldsymbol{\theta}|\mathbf{Y}) = \frac{P(\mathbf{Y}|\boldsymbol{\theta})P(\boldsymbol{\theta})}{P(\mathbf{Y}|\boldsymbol{\theta})P(\boldsymbol{\theta})+P(\mathbf{Y}|\sim\boldsymbol{\theta})P(\sim\boldsymbol{\theta})} = \frac{P(\mathbf{Y}|\boldsymbol{\theta})P(\boldsymbol{\theta})}{P(\mathbf{Y})} \quad (1)$$

Whereas $\boldsymbol{\theta}$ represents an exhaustive set of mutually incompatible competitive advantage hypotheses or theories, and $\mathbf{Y}$ represents a collective set of empirical performance indicators.

Given that heterogeneous performance deductively entails different configurations, they subsequently extended the posterior probability $P(\boldsymbol{\theta}|\mathbf{Y})$ in equation (1) to the general conditional $P(\boldsymbol{\theta},\psi|\mathbf{Y})$, where ψ is an auxiliary equifinality proposition representing a mixture of heterogeneous resource bundles $\boldsymbol{x}$ and their associated weights $\boldsymbol{\lambda}$, $\psi = (x,\lambda)$. The causal series can be extracted by the Bayesian discriminant model (Sivia 1996), which assumes that the population of firms is composed of two unaffiliated factions: those with competitive advantage and those without (i.e., having competitive disadvantage).

$$\boldsymbol{P}(\theta|\boldsymbol{Y}) + \boldsymbol{P}(\sim\theta|\boldsymbol{Y}) = 1 \quad (2)$$

$$P(\boldsymbol{\theta},\psi|\mathbf{Y}) = P(\boldsymbol{\theta}|\psi,\mathbf{Y}) \times P(\psi|\mathbf{Y}) \quad (3)$$

The probabilities of the competitive advantage hypotheses $\boldsymbol{\theta}$ are straightforward. Statistical inference of competitive advantages (and competitive disadvantages) comes from inductive reasoning based on the unobserved configurations of heterogeneous resource bundles ψ and the empirical evidence of superior performance $\mathbf{Y}$.

To determine sources of competitive advantage that in turn causes superior financial performance, Tang and Liou used financial data to conduct the inferences of competitive advantage. Firstly, they selected the return on invested capital (ROIC) to measure a firm's sustainable superior performance and/or value creation. Secondly, the firm's resource bundles $\boldsymbol{x}$, such as advertising and accounts receivable, are treated as driving elements of ROIC. Thirdly, the configuration weights $\boldsymbol{\lambda}$ represent dynamic

linkages such as operating efficiency and capital leverage that interconnect resource bundles. Lastly, the identified four-dimension configuration of interconnected resource bundles including customer relationships, intellectual property, and fixed asset management that might lead to sustainable competitive advantage.

2.2 The Sustained Competitive Advantage and the Indicators

"Sustainable competitive advantage is the unique position that an organization develops inrelation to competitors that allows it to outperform them consistently" (Hofer and Schendel,1978). In addition, sustainable competitive advantage is defined as "above-average performance in the long run" (Porter, 1985:11), with the amount of time defining the "long run" not specified. There is increasing strategic theorists believed that sustained competitive advantage is not feasible at firm level in a hypercompetitive, high-velocity, hyper-turbulent, and chaotic environments (e.g., Brown & Eisenhardt, 1998; D'Aveni, 1994; Eisenhardt and Martin, 2000; Hamel, 2000; Dawai, 2004). As the advantage of entry barriers and low cost might erode in a short term, the firm can only pursue temporary or a series of competitive advantage. To tackle the competitive dynamics, the speed and aggressiveness of firm actions determine the effectiveness of a firm's position and movements. Dynamic capabilities are defined as the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly-changing environments (Teece et al., 1997). The dynamic resource configuration model proposed by the present study investigates which resource bundles and managing capabilities contribute to the trajectory of competitive advantage in a specific period. One of problem associating with analysis of competitive advantage is that neither the traditional long-term sustainable argument nor the short-term temporary view of competitive advantage specifies the time span for observing competitive advantage.

Although the common theme of competitive advantage is value creation in the strategic literature (e.g., Porter, 1985; Hoopes, Madsen and Walker, 2003; Besanko et al, 2004), there is no common understanding on to who and when the value is created (Rumelt, 2003). Some of the definitions take an absolute concept of competitive advantage The competitive advantage is usually defined as firms that can (1) assess excess return, above normal return, or excess value added (Porter, 1985; Brandenberger and Stuart, 1996; Key, 1993); (2) outperform its rivals (Barney, 2002; Peteraf, 1993); and (3) earn returns or profits above industry average or its rivals (Besanko, Dranove, and Shanley, 2000; Feigenbaum and Thomas, 1988; Ghemawat and Rivkin, 1999; Gooding, Goel, and Wiseman, 1996; Grant, 1991; Hunt, 2002; Schoemaker, 1990; Jones and Hill, 2004). The commonly used financial variables to

present the existence or absence of competitive advantage include absolute-amount variables (such as sales, net income), rate-of-return indicators (on total assets, equity, or invested capital), marginal earnings (net profit margin and earnings per share), and market-indicators (tobin's q and its approximate, market-to-book ratio, price-earnings ratio). Most studies randomly select one (or two) of these financial variables to distinguish firms with competitive advantage from those without. Using a single financial variable to indicate the existence of sustained competitive advantage can be problematic since the financial variable is based on a single fiscal year while sustained competitive advantage is defined as a firm's ability to generate long-term superior performance.

The financial outcomes of an organization are a function of a variety of factors, including industry environment, organizational strategy, and organizational characteristics (White and Hamermesh, 1981). Many financial performance indicators have been used to indicate the competitive advantage in previous empirical researches. These indicators can be grouped into two categories: accounting ratio and market. The commonly used accounting indicators for competitive advantage include physical amount and profitability ratios. The profitability ratios include return on invested capital (ROIC), return on equity (ROE), return on assets (ROA), earnings per share (EPS), price-earning (PE) ratio, profit margin (PM), and Tobin's q, which can be approximated by the market-to-book ratio (MTB). The amount-type indicators include sales, total assets (TA) and market value (MV).

Table 2-1 Financial performance indicators used to indicate competitive advantage

References	Indicators used	Criterion of superior performance	Methodology / Objective
Denrell, Fang, Zhao (2013)	ROE	ROE>industry median	Time stochastic process based on Rank-based performance percentile to distinguish ability vs. luck
Henderson, Raynor, Ahmed (2012)	ROA, Tobin's q	Number of years ranking in distinguished percentile > bench mark (by simulation)	Marcov process used to distinguish ability vs. luck
Chari, Parthiban (2012)	ROA	ROA>industrial norm	First-order regression model used to test the persistence of performance)
Tang, Liou (2010)	ROIC	ROIC> industry average	Discriminant analysis used to distinguish firms with competitive advantage from those without
Kumar,	Sales and	Increasing over study	Multilevel linear model

Venkatesan, Leone (2011)	profit	period	
Jiang et al. (2012)	ROA,ROE, market return, sale growth	Relative performance	Regression model

3. METHODOLOGY: LATENT CLASS GROWTH ANALYSIS

Although the strategic management scholars emphasize the dynamic feature and the firm's ability to confront changes over time, most of the studies have been static in concept (Priem and Butler, 2001). Recently, more and more research articles use cross-section longitudinal data to study sustainability of firm performance (e.g., Denrell, Fang, Zhao, 2013; Henderson, Raynor, Ahmed, 2012). The annual financial reports enable us to observe the long-term trajectory of performance, and hence, the competitive advantage, of the firms.

Conventional growth modeling approaches give single average growth estimate (a single estimation of variance of the growth parameters) and assume a uniform influence of covariates on the variance and growth parameters, given a typical sample of individual growth trajectories. However, there may exist a subset of individuals whose growth trajectories are significantly different from the overall estimate. Raudenbush & Bryk (2002) describe the conventional growth model as a multilevel, random effects model. In this framework, intercept and slope vary across individuals and this heterogeneity is captured by random effects (i.e., continuous latent variables). However, this approach assumes that the growth trajectories of all individuals can be adequately described using a single estimate of growth parameters. The underlying assumption of this framework is that all individuals are drawn from a single population with common parameters. Generalized method of moment (GMM) relaxes this assumption and allows for differences in growth parameters across unobserved subpopulations. This is accomplished using latent trajectory classes (i.e., categorical latent variables), which allow for different groups of individual growth trajectories to vary around different means (with the same or different forms). The results are separate growth models for each latent class, each with its unique estimates of variances and covariate influences.

Latent class growth analysis (LCGA) is a special type of GMM, whereby the variance and covariance estimates for the growth factors within each class are assumed to be fixed to zero (Jung & Wickrama, 2008). By this assumption, all individual growth trajectories within a class are homogeneous. This framework of growth modeling has been extensively developed by Nagin and colleagues (cf. Nagin & Land, 1993) and is embodied in the SAS procedure Proc Traj (Jones, Nagin, & Roeder, 2001). This latent curve models are useful for identify a developmental process which captures average intraindividual change on the outcome over time and the variation across individuals in this rate of change (Sturgis and Sullivan, 2008). It uses repeated measures to estimate a growth trajectory which is latent, with the observed repeated measures treated as an imperfect indicator of the underlying trend (Curran and Bollen, 2001). The simple LCGA illustrates the individual linear

trajectories in a developmental process over *p* periods of a panel. Equation (4) indicates that each individual's status with respect to the continuous variable of interest, *y* (the financial performance), changes at a constant rate but that these rates vary over the population of individuals (the firms).

$$\boldsymbol{y_{it} = \alpha_i + \beta_i x_t + \varepsilon_{it}} \quad (4)$$

where

y_{et} is individual firm *i*'s (i=1, 2,…,*n*) score on the continuous outcome *y* at year *t* (*t* = 1,2,…*p*), x_i is the year, α_i is the intercept of the growth trajectory for individual firm *i*, β_i is the slope of the growth trajectory for firm *i* and ε_{it} is the time-specific residual of firm *i* at time *t*. McArdle and Nesselroade (2003) suggest several ways to specify dependence on time to represent linear and non-linear change. Where a curvilinear trajectory is significant, a quadratic term, or higher order polynomial, may be added to equation (4). It is common to assign 0 to *x* for time point 1 and the average of α_i is represents the mean of the trajectory of *y* at the first year of measurement (Biesanz *et al*., 2004).

For binary or categorical outcome (e.g competitive advantage vs. competitive disadvantage in this research), logit regression is used to estimate the growth parameters. In the structural equation modeling framework, it is conventional to use a latent variable specification of this model, in which y^* (the firm's status of competitiveness) replaces *y* (the original financial variables) in equation (4) to denote the observed categorical outcome. Under this specification, y^* is an underlying and unobserved continuous variable that is linked to *y* by an auxiliary threshold model (such as firms which performances have achieved above-industry average have competitive advantage.), which defines the "cut points", at which the ordered categories in *y* are located on the underlying continuum y^* (Methta *et al*., 2004). In equation (4), β_i denotes the change in the log-odds that individual *i* in category *j* of the ordinal outcome, or the other one, for a unit change in *x*. These model parameters are expressed as in the form of predicted probabilities of membership in each category of *y*, at each point in time (Long, 1997).

This multiple-group framework that separate models can be fitted for each of the different groups and relaxes the between-group parameter constraints described above (McArdle and Hamagami, 1996). The latent class group analysis, which is a type of multiple-group framework, *extends the basic latent curve model by identifying k latent classes with qualitatively distinct developmental trajectories, with different growth parameters estimated for each of the k latent classes or groups* (Sturgis and Sullivan, 2008). Rather than defined by the observed outcomes themselves, the latent trajectory

group variable is explored by applying finite mixture models to variation in individual growth parameters (Bollen and Curran, 2006; Jones *et al*., 2001). In LCGA, no between-individual variation in growth is designated within each latent trajectory group and the variances of the intercept, slope, and higher order growth parameters are fixed to 0 within each group.

The development of paths of different groups may be extracted by a two-step approach: allocate the subjects to one and only one latent class at the first step and regress the class membership variable on covariates in a second step. This approach can result in biased parameter and variance estimates because class membership is treated as determined rather than stochastic (Block et al., 2004). In the LCGA framework, the mixture and multinomial regression parts of the model are estimated in a single step, with a global likelihood for the model (Sturgis and Sullivan, 2008).The LCGA allocates each firm a high probability of being in one trajectory group and a low probability of being in all the others (Muthén, 2004). The posterior probabilities of firm level membership in each latent (competitiveness) trajectory group (or class) are used to identify the class to which each firm is most likely to belong. In conjunction with the firm level posterior probabilities, the 'most likely group' assignation is used to assess the sensitivity, with which the model allocates firms to trajectory groups. The LCGA not only can describes the optimal number of different latent groups of firms and the shapes of their trajectories on the firm performance over time, but also allows us to model the probability of competitive trajectory group membership as a function of covariates (Strugis and Sullivan, 2008). The latent trajectory group variable $\boldsymbol{c}$ with $\boldsymbol{k}$ categories and a single covariate $\boldsymbol{y}^*$, the covariance effect on class membership is a multinomial logistic regression,

$$\boldsymbol{P}\left(\boldsymbol{C_i} = \boldsymbol{k}\middle|\boldsymbol{y_i^*}\right) = \frac{\boldsymbol{e}^{\mu_{0k}+\mu_{1k}y_i^*}}{\sum_{s=1}^{K}\boldsymbol{e}^{\mu_{0s}+\mu_{1s}y_i^*}} \tag{9}$$

for $\boldsymbol{k}$ =1,…,$\boldsymbol{K}$ and where $\boldsymbol{P}\left(\boldsymbol{C_i} = \boldsymbol{k}\middle|\boldsymbol{y_i^*}\right)$is the probability of membership of trajectory group *k* conditional on $\boldsymbol{y}^*$. The $\boldsymbol{K}$ probabilities sum to 1 so some constraint must be imposed on their freedom to vary over the parameter space. It is usually convenient to normalize by choosing *K* as the reference trajectory group and setting μ_{0k} =0 and μ_{1k} =0. Equation (1) denotes this characterization (Long, 1997).

$$\ln\left\{\frac{\boldsymbol{p}\left(\boldsymbol{c_i} = \boldsymbol{k}\middle|\boldsymbol{y_i}\right)}{\boldsymbol{p}\left(\boldsymbol{c_i} = \boldsymbol{K}\middle|\boldsymbol{y_i}\right)}\right\} = \mu_{0k} + \mu_{1k}\boldsymbol{y} \tag{10}$$

The condition on *c* and the subscript *k* in equation (10) emphasize that the growth model for $\boldsymbol{u}$ (expressed by the logits or odds ratio) varies across classes. For a unit change in *y*, the change in the log (odds) of being in trajectory group $\boldsymbol{k}$ relative to the reference trajectory group *K* is $\boldsymbol{\mu}_{1k}$. The growth models of different latent classes vary, with major differences in the μ coefficients (Muthén, 2004).

3.4 Missing data

When the longitudinal measurements on certain categories of individuals are censored or truncated due to dropout or death, the opportunity to measure interesting trajectories of behaviors or outcomes may be lost. For intermittent missing, the PROC TRAJ macro for LCGA assumes that missing data are missing at random, and the model is adjusted so that missing observations do not contribute to the sample size or analytical outcome (Nagin and Tremblay, 2001). However, firms that delisted from the market due to bankruptcy or acquisition, the missing data is non-neglected. The LCGA assumes that latent trajectory group membership is inter-correlated of attrition and allows for estimation of additional quantities relevant when attrition is present. The attrition process in the LCGA is directly modeled and allows for variation across trajectory groups. The model permits dropout (or delist in this study) probability to vary as a function of observed outcomes prior to dropout or delist. Therefore, the model estimate the trajectory specific attrition rates and the resulting trajectory group probabilities over time for the remaining population after attrition (see Haviland, Jones and Nagin, 2011 for details).

3.5 Fit Index

The trajectory procedure in SAS (Jones et al., 2001) uses Bayesian information criterion to determine the best model. Bayesian information criterion (BIC), is given by Equation (6):

$$\boldsymbol{BIC} = \log(\boldsymbol{L}) - 0.5 \times \log(\boldsymbol{n}) \times \boldsymbol{k} \tag{6}$$

whereas
L = likelyhood; n = sample size; and = number of parameters.

BIC starts with the log likelihood value and then penalize for the number of covariance parameters estimated, providing that BIC employing a stiffer penalty. For each of these indices values closer to zero represent better fit. This approach, however, does not always lead to identification of the correct covariance model, especially when data are somewhat limited. For example, with repeated measures data, it is

difficult to correctly select the covariance structure when the series length is short (Ferron, Dailey and Yi, 2002; Keselman, et al., 1998).

Jones, Nagin and Roeder (2001) uses the change in the BIC between two models to measure the weitht of evidence against the null model. For each increasing complex model that is tested, the BIC of the more complex (larger number of groups, or higher order equation) less the BIC of the less complex model is used to select the model that better fits the dat. The null model is always the simpler model (less groups, or lower oder equations). The interpretation of the logged Bayes factor ($2\times\Delta\boldsymbol{BIC}$) in terms of model preferences is shown in Table 2.

$$\Delta\boldsymbol{BIC} = \boldsymbol{BIC}_{(comolex)} - \boldsymbol{BIC}_{(null)}$$

Table 3-1 Interpretation of logged Bayes factor ($2\times\Delta\boldsymbol{BIC}$) for model selection

2*ΔBIC	Evidence against Ho
0 to 2	Not worth mentioning
2 to 6	Positive
6 to 10	Strong
> 10	Very Strong

Source: Nagin (2005).

4. EMPIRICAL STUDIES

The fundamental concept of interest of this research is the distribution of performance of firms conditional on time; that is, the distribution of performance trajectories denoted by $P(Y_i|T_i)$, where the random vector Y_i represents firm *i*'s longitudinal sequence of operation performance and the vector T_i represents fiscal year when each of those outcomes is recorded. The group-based trajectory model assumes that the population of trajectories arises from a finite mixture of unknown order *j*. For given *j*, conditional independence is assumed for the sequential realizations of the elements of *Yi* , *yit*, over the *T* periods of measurement as shown in equation (9):

$$P(Y_i|T_i, j; \beta^j) = \prod_{t=i}^{T} P(y_{it}|T_i, j; \beta^j) \tag{9}$$

where *p*(.) is the distribution of y_{it} conditional on membership in group *j* and the fiscal year of firm i at time t.

The group-based trajectory analysis was performed with the SAS PROC TRAJ macro (Jones, Nagin and Roeder, 2001). Unlike traditional regression or growth curve procedures which only model one mean, SAS® Proc Traj models patterns of change over time in the dependent variable and identifies distinct subgroups within the population (Nagin and Roeder 2001).

The SAS PROC TRAJ procedure estimates two models simultaneously by using Maximum Likelihood Estimation approach. In the case of this research, one of the two models estimates the probability of being in each homogenous latent group, identification for each firm based on the time-independent covariates (sustainability). The other model estimates the trajectory (slope) of each homogeneous group (in terms of performance) over time. A risk factor, economic growth, affects the likelihood of a particular data trajectory is included but it is assumed that nothing more can be learned about the data from risk factors, given group identification. The Bayesian Information Criterion (BIC) is used in model selection. The objective of model selection is not the maximization of some statistic of model fit; rather, it is to summarize the distinctive features of the data in as parsimonious a fashion as possible (Nagin, 2005).

The dataset covers 13 years, however, for companies that listed in stock exchange latter than 2000 and those unlisted (being bankrupt or acquired) during the period have year counts less than 13 years. There are missing data if the companies have no operation. These companies should not be deleted since they are part of the market during their operation. However, in order to assess the long-term trajectory of firm

performance, this research limits the model to only estimating classifications for firms which have data for five or more years. The parameters for the trajectory model were determined on a maximum-likelihood basis by a general quasi-Newton method (Dennis et al., 1981; Jones and Nagin, 2005). The explained variable is the annual performance of the individual firms. Firms are designated as superior to their rivals in the industry and assigned a value of 1 for the fiscal year if they meet both of the two criteria: (1) the performance is above industry average and positive, and (2) they are not dropout (unlisted) from the stock market during the study period; a value of 0 is given otherwise. The explained variables are time factor from 0 to 12 denoting the period of 2000 to 2012. In addition, annual economic growth rates are included in the LCGA model to exclude environmental effects on firm performance.

4.1 Semiconductor and Related Devices

Firms in the semiconductor and related devices industry primarily engaged in manufacturing semiconductors and related solid-state devices. Important products of this industry are semiconductor diodes and stacks, including rectifiers, integrated microcircuits (semiconductor networks), transistors, solar cells, and light sensing and emitting semiconductor (solid-state) devices. In the Standard Industrial Code (SIC), these firms are classified in Semiconductor and Related Device Manufacturing (#3674). The semiconductor/IC industry has developed several highly dependent partitions over the years, with firms dealing in intellectual property (e.g., NXP and IBM), integrated circuit design (e.g., Qualcomm and NVIDIA), wafer foundry (e.g., TSMC), and IC assembly (e.g., Advanced Semiconductor Engineering). This industry shows moderate average annual growth of sales (5.0%) during the past five years.

The four-firm concentration rate decreased dramatically from 56.2% in 2000 to 37.8% in 2006, which reveals that this industry had been diversified due to commoditization of chip prices, and lower barriers to entry into the industry for start-ups (e.g., SMIC) at the first half of last decade. However, the market re-concentrated afterward to 48.6% in 2012, which indicates that some firms have grown much faster than others at the second half of last decade. There are 245 companies included in the class of semiconductor and related devices industry in the Compustat database. There are 1533 companies included in the Compustat database from 2000 to 2012. To avoid the possibility of mismeasured outliers influencing the full sample, the present study deletes, for every year separately, companies with any one of the seven indicators smaller than the corresponding mean minus three times standard deviation for that year. The complete date set contains 1333 companies. Table A1 in Appendix 1 reports summary statistics. After removing companies with

less than 5-year data, 181 companies are included in the following trajectory analysis.

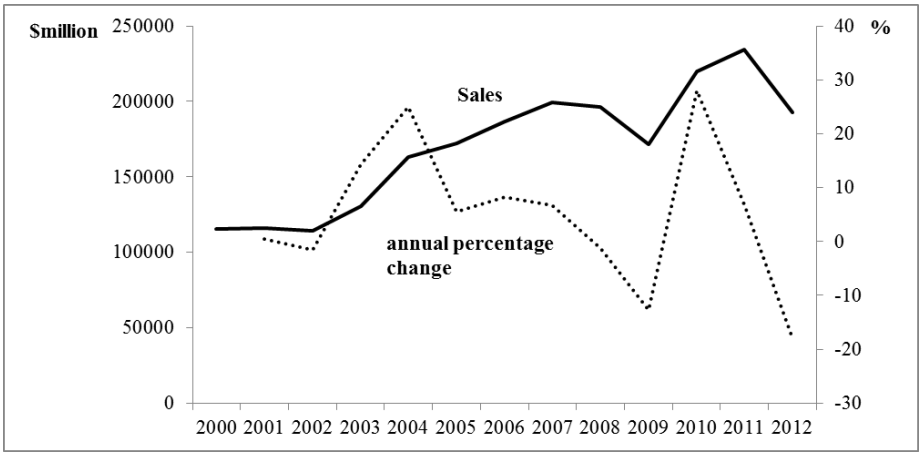


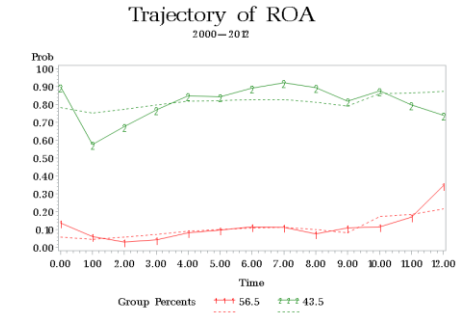
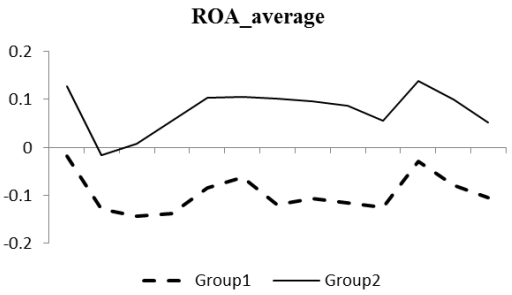
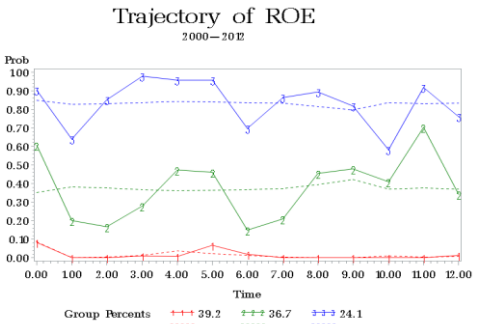
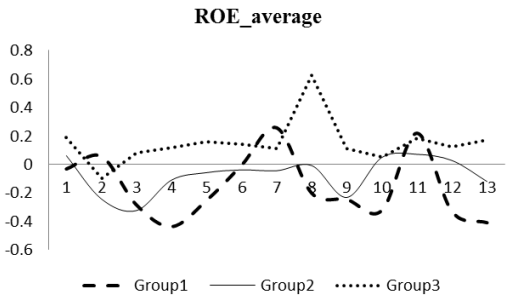
Figure 4-1. Growth at industry level vs. at firm levels- Selected industries

The study uses multinomial logit models of trajectory analysis to identify groups and the shapes of the slopes of time-variant performance. The number of groups and the associated parameters are determined to maximize the BIC. Table 4-1 reports the results of the model fit. Figure 4.2 shows the performance trajectories identified by the latent class growth logit model with each of the seven performance indicators. The average data is represented by the solid lines and the predicted trajectories are represented by the dashed lines. The X-axis represents fiscal year and the Y-axis the outcome, that is, the prevalence of superiority of performance during the study period, dichotomously coded as one or zero. The text output is listed in Appendix 1. For each group the intercept parameter is listed first. Second, if there are, the linear, quadratic, and cubic coefficients for time (i.e., year) are presented. Third, the group membership probabilities are listed. Lastly, BIC values are shown for the data points and number of subjects. Table 4-2 summarizes the results of the grouping about the group percent, and the average times that the companies achieved above-industry- average performance relative to the average number of year counts. The findings are described below.

Table 4-1 Results of Model Fitting (SCI=3674)

	ROA	ROE	ROIC	PM	MTB	EPS	PE
Group 1							
Intercept	-3.3***	-7.7***	-2.1***	-4.2***	-3.7***	-4.3***	-3.5***
Linear	0,14**	—	-0.3**	—	0.2**	—	—
Quadratic	—	—	0.04***	—	—	—	—
Eco Growth	12.9	127.3*	5.7	27.9	2.5	-7.6	16.3
Group 2							
Intercept	0.95***	-0.4**	0.8*	-0.3*	1.1***	-0.7***	-0.9**
Linear	0.07*	—	0.2***	—	—	—	—
Quadratic	—	—	-0.02***	—	—	—	—
Eco Growth	7.7	-3.9	4.7	10.8*	-0.2	-0.9	18.9**
Group 3							
Intercept		1.5***		2.3***		1.1***	1.9***
Linear		—		—		0.2***	—
Quadratic		—		—		—	—
Eco Growth		4.8		8.0		7.6	-45.8**

*p<0.05; **p<0.01; ***p<0.001

Original indicators (group average)	*Trajectory of Performance
	
(a-1)	(a-2)
	
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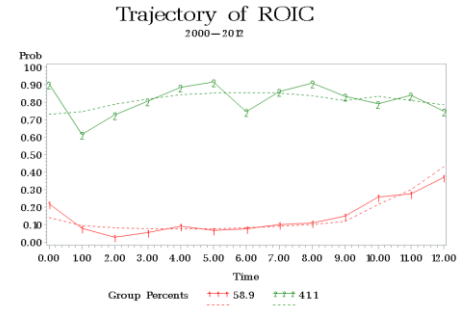	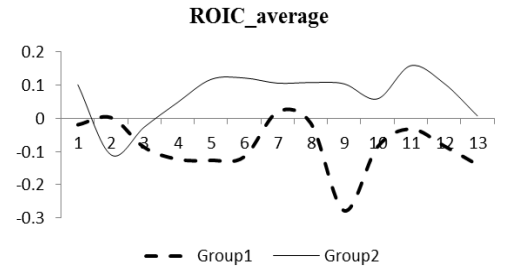
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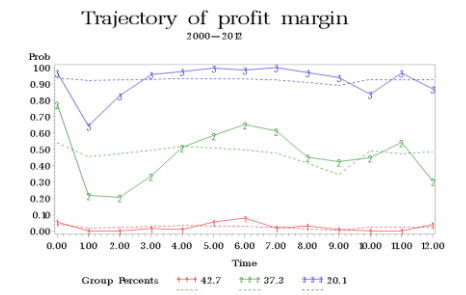
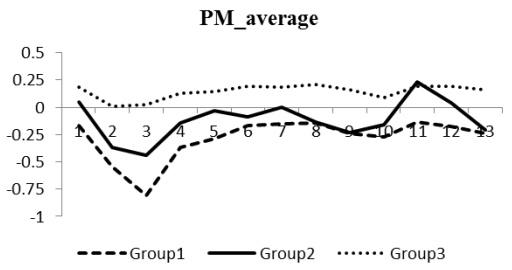
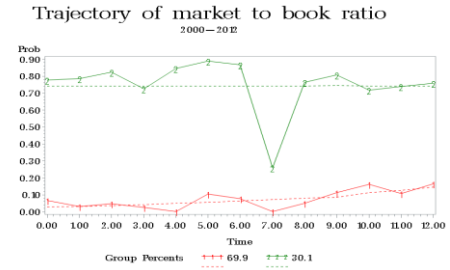
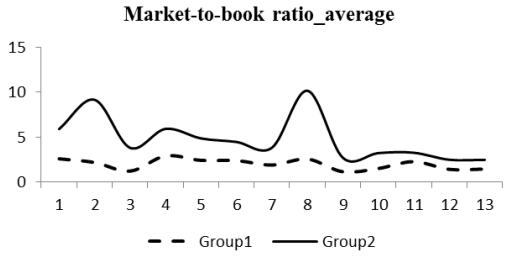
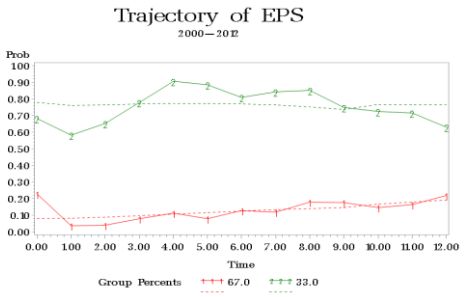
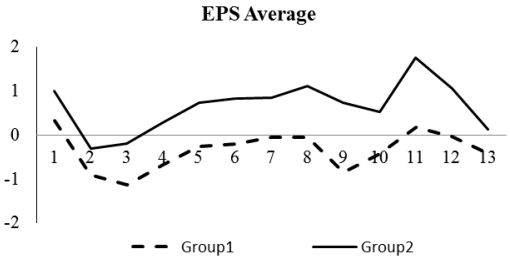
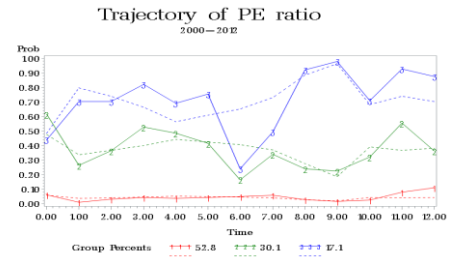
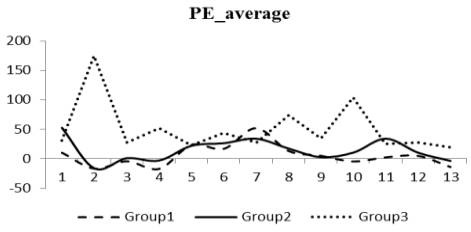
	
(d-1)	(d-2)

Original indicators (group average)	*Trajectory of Performance
	
(e-1)	(e-2)
	
(f-1)	(f-2)
	
(g-1)	(g-2)

* $P\left(Y_i \middle| T_i, j; \beta^j\right) = \prod_{t=i}^{T} P\left(y_{it} \middle| T_i, j; \beta^j\right)$; The firm is defined as superior and assigned a status of 1 if the respective performance indicator is positive and above industry average in the specific year; 0 is assigned otherwise.

Figure 4-2 Trajectories of firm performance with various performance indicators (SIC=3674)

Table 4-2 Resluts of grouping by trajectories of performance (SIC=3674)

Indicator	No. of	group percent			Times above average/Year counts		
Groups	Observations.	1	2	3	1	2	3
Return on assets	145	56%	43%*		1.0/ 9.0	9.1/ 11.1	
Return on equity	145	39%	37%	24%*	0.1/ 8.4	4.1/ 10.7	9.4/ 11.2
Return on invested capital	145	58%	41%*		1.1/ 9.0	9.0/ 11.0	
Profit margin	145	42%	37%	20%*	0.2/ 8.4	5.1/ 10.6	10.7/ 11.5
Market-to-book ratio	117	70%	30%*		0.6/ 9.4	8.0/ 10.8	
Earnings per share	143	67%	33%*		1.2/ 9.2	8.7/ 11.2	
Price-earnings ratio	135	53%	30%	17%*	0.4/ 8.5	4.4/ 11.1	8.3 /11.4

*The group in which Google is classified.

1. The LCGA using the status of superior performance based on ROA identifies two groups, all of which fits a linear shape. Table 4-2 shows that Group 2 (43%) achieved superior performance 9.1 times out of an average 11.1 year counts. As shown in Figure 4-2(a-2), the average ROA trajectory of Group 2 has higher ROAs than Group 1 over time.
2. The model based on ROE signifies three groups. Group 3 (18%) is the best performer, which achieved superior performance 9.4 times out of 11.2 operating years. Group 1 (39%) has reached superior performance near zero times during the 8.4 operating years in average. It is 4.1 times out of 10.7 operating years for Group 2. Figure 4-2(b-2) presents the trend of ROE of these three groups. Google is classified in Group 3 with this indicator.
3. The model based on ROIC classifies the sample companies into two groups, both of which fit quadratic shapes. Group 2 (41%) has performed superior to the Group 1 (58%) as shown in Figure 4.2(c-1). Group 2 achieve 9.0 times out of an average of 11.0 operation years while it is only 1.1 times out of 9.0 operation years for Group 1.
4. The model based on PM identifies three groups, each of which fits linear shape. Group 2 (20%), which performs the best, has achieved superior performance 10.7 times out of an average of 11.5 operation years. Group 1 (54%), which has only 8.4 operation years in average, reached superior performance 0.2 times. With 10.6 operation years in average, Group 2 reached superior performance 5.1 times.

5. MTB ratio identifies two groups. The shape of the trajectories of Group 1 is linear while that of Group 2 is fixed. Group 2 (30%), which performs better than Group 1, has achieved superior performance 8.0 times during the 10.8 operation years. Group 1 (70%%) reached only 0.6 times during the 9.4 operation years..
6. EPS signifies two groups. The trajectories of Group 1 has a linear shape while Group 2 is relatively constant. Group 2, which performances better than Group 1, achieved superior performance 8.7 times out of the 11.2 operation years. Group 1 reached only 1.2 times out of the 9.2 operation years.
7. PE ratio identifies three groups. The trajectory of all groups is independent from time. Group 3, which performs the best among the three groups, has reached superior performance 8.3 times out of 11.4 operation years while Group 1 reached only 0.4 times out of 8.5 operation years in average.

Out of the 145 sample firms, the number of firms that are identified as superior to the rivals ranges from 23 (by PE) to 62 (by ROA) depending on the indicator used. Most companies classified in the best group in one indicator may not be in the best group classified by other indicators. Only 13 companies, which is named "winners' club" in this research, are classified in the best-performing group by each of the seven indicators. The number increases to 22 and 33 respectively if more than 6 or more than 5 indicators ore used to define the superior performance. Table 4-3 lists the 13 companies which are grouped to the best group by each of the seven indicators. Companies in the Winners' Club such as Qualcomm and Intel are recognized as successful firm in their domain.

Table 4-3 Winners' Club (SCI=3674)

Company	Operation years	Percentage of number of years achieving superior performance						
		ROA	ROE	ROIC	PM	MTB	EPS	PE
Identified by all seven indicators								
Silicon	13	92%	77%	85%	92%	92%	92%	77%
Maxim Integrated	12	100%	92%	92%	92%	75%	92%	83%
Altera Corp.	13	100%	92%	100%	92%	100%	92%	54%
Analog Devices	12	100%	100%	100%	100%	92%	100%	67%
Hittite	10	100%	100%	100%	100%	100%	100%	88%
Ipg Photonics	9	100%	100%	100%	100%	86%	67%	100%
Qualcomm	12	100%	92%	100%	92%	92%	92%	75%
Microchip	12	100%	100%	100%	100%	100%	100%	75%
Qlogic Corp.	12	100%	100%	100%	100%	83%	100%	50%
Micrel Inc.	13	85%	92%	92%	92%	92%	85%	69%
Intel Corp.	13	100%	100%	100%	100%	85%	100%	46%
Power Integrations	13	100%	77%	92%	92%	77%	92%	85%
Semtech	12	100%	83%	92%	100%	75%	100%	75%
Identified by six indicators only (excluding the above companies)								
Supertex	12	92%	92%	83%	100%	25%	92%	75%
Texas Instruments	13	92%	85%	92%	85%	92%	85%	31%
Arm Hold	13	100%	77%	100%	100% .		62%	92%
Volterra	11	73%	64%	73%	82%	89%	73%	100%
Mellanox	9	78%	78%	78%	78%	67%	44%	83%
Nve Corp.	12	83%	92%	92%	92%	92%	83%	67%

4.2 The services industry

Services, when offered by a products company, are usually complementary activities meant to assist in promoting adoption of the core product or to enhance the core product. In the present study, when software products companies report revenues from services, they are generally referring to activities such as product customization to create features or user interfaces tailored to a customer's special needs, or consulting to plan and implement these software solutions, or integration work to make different software products or databases operate together. They also may be referring to training on how to use new software. In addition, perhaps half or more of services for many software product firms selling to large organizations consist of revenues from maintenance contracts that cover technical support to rectify problems and provide upgrades of new versions of the software at long as usage terms (such as

the number of users and the specific functional modules being licensed) do not change.

The layered structure of software systems, especially for enterprise users, as well as the changes in technology platforms over time, has made the software industry especially ripe for services. *Different layers in the stack represent subsystems that can change at different rates. But all the layers must work together in order to function. As a result, if a particular market advances at a faster rate than other levels in the stack, it must still integrate with the older versions to work. Over time, standard interfaces and integrating technologies such as XML have reduced this burden, but the market structure and technical reality of software systems helps sustain this need.* Services have also become more important over time as a source of revenues and profits as hardware prices and then software product prices declined with the advent of cheap personal computers and open-source programs. Figure 3 shows the percentage of revenues from services vs. from products in Oracle and Siebel.

The leading producer of database, Oracle, organized its own consulting group and began to hire executives with consulting backgrounds in 1986. Third party consultants began to offer system integration services in the mid-1980s to help customers integrate and manage their increasingly heterogeneous technology infrastructure (Kahn, et. al, 1989). In the early 1990s, consultants connected this client/server technology with the principles of business process re-engineering and started leveraging this new technology to radically reconfigure how manufacturers organized their business processes. In the case of the Internet, software firms began to offer new services that helped measure the value from implementing a system and got involved in establishing new Internet marketplaces, such as Covisint, to exchange goods within an industry. They also started experimenting with offering their products as a service, in which the application is hosted by a third party accessed by the customer.

The sample in this research include companies classified in SIC code 7370 (computer programming and data process), 7371 (computer programming services), 7372 (prepackaged software), 7373 (computer integrated system design), 7374 (computer processing and data preparation services), and 7377 (computer rental and leasing). There are 1533 companies included in the Compustat database from 2000 to 2012. The present research deleted companies with any one of the seven indicators smaller than the corresponding mean minus three times standard deviation; 1333 companies are in the adjusted dataset. The descriptive statistics of the dataset are given in Appendix 2. Companies with data less than 5 years are deleted and consequently resulted in a total of 681 companies for the following trajectory analysis.

The study uses multinomial logit models of trajectory analysis to identify groups

and the shapes of the slopes of time-variant performance. Table 4-4 reports the results of the model fit. Figure 4-5 shows the performance trajectories identified by the latent class growth logit model with each of the seven performance indicators. The average data is represented by the solid lines and the predicted trajectories are represented by the dashed lines. The X-axis represents fiscal year and the Y-axis the outcome, that is, the prevalence of superiority of performance during the study period, dichotomously coded as one or zero. The text output is listed in Appendix 2. For each group the intercept parameter is listed first. Second, if there are, the linear, quadratic, and cubic coefficients for time (i.e., year) are presented. Third, the group membership probabilities are listed. Lastly, BIC values are shown for the data points and number of subjects. Table 4-5 summarizes the results of the grouping about the group percent, and the average times that the companies achieved above-industry- average performance relative to the average number of year counts. The findings are described below.

1. The LCGA using the status of superior performance based on ROA identifies three groups, all of which fits a fixed pattern that is independent from time. Group 3 (25%) presents a stable trajectory of being superior during the study period. Table 4-4 shows that Group 3 achieved superior performance 9.8 times out of an average 10.9 year counts. In average, Group 3 has never reached superior performance during an average of 7.5 operating years. The firms in this group have operated on the axis of errors (Powell and Arregle, 2007). As shown in Figure 4-3a-2, the average ROA trajectory of Group 3 has the highest ROAs over time. Group 2, which has reached superior performance around four times out of an average of 10 year-counts is narrowing the gap with Group 3. Google is classified in Group 3 by ROA.
2. The model based on ROE signifies three groups. Although the trajectories are volatile, they are independent from time. Group 3 (18%) is the best performer, which achieved superior performance 7.2 times out of 10.1 operating years. Group 1 (49%), which almost consists of half of the sample companies, has reached superior performance zero times during the 7.4 operating years in average. It is 4.5 times out of 10.7 operating years for Group 2. Figure 4-3b-2 presents the trend of ROE of these three groups. Google is classified in Group 3 with this indicator.
3. The model based on ROIC classifies the sample companies into two groups, both of which fit quadratic shape. Group 2 (38%) has performed superior to the Group 1 (62%) as Figure 4.3(c-1) shows. Figure 4.3(c-2) illustrates the rank of the superiority among these four groups. Group 4 achieve 5.4 times out of the 9.5 operation years while it is only 0.2 times out of an average of 8.0 operation years

for Group 1. Google is classified in Group 2 by ROIC.

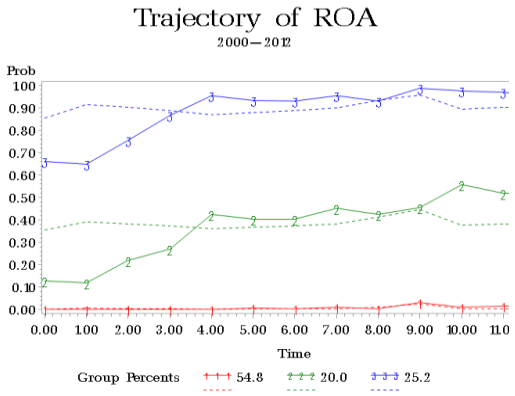
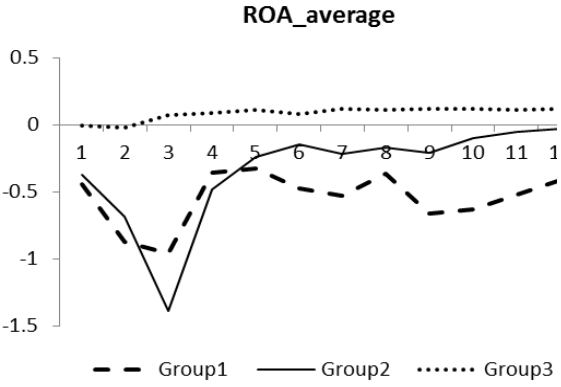
4. The model based on PM identifies three groups, of which, Group 1and Group 3 fit linear shape while Group 2's shape is quadratic. Group 2 (23%), which performs the best, has achieved superior performance 9.4 times out of an average of 10.9 operation years. Group 1 (54%), which has only 7.5 operation years in average, reached superior performance 0.1 times. With 10.3 operation years in average, Group 2 reached superior performance 4 times. Google is classified in Group 2 by PM.
5. MTB ratio identifies three groups. The trajectories of Group 1 and 2 are independent from time while it fits a quadratic shape for Group 3. Group 3, which performs the best among the three groups, has achieved superior performance 7.7 times during the 10.4 operation years. Group 1 (55%) reached only 0.1 times during the 7.7 operation years. Google is classified in Group 3 by MTB.
6. EPS signifies three groups. The trajectories of Group 1 and 2 are independent from time while that of Group 3 fit a linear shape. Group 3, which performances the best among the three groups, achieved superior performance 10.1 times out of the 11.2 operation years. Group 1 reached only 0.1 times out of the 8.0 operation years. Google is classified in Group 3 in EPS.
7. PE ratio identifies two groups. The trajectory of Group 1 is independent from time while that of Group 2 fits a quadratic shape. Group 2, which performs better than Group 1, has reached superior performance 6.1 times out of 11 operation years while Group 1 reached only 0.2 times out of 7.9 operation years in average. Google is classified in Group 2.
8. Out of the 681 sample firms, the number of firms that are identified as superior to the rivals ranges from 87 (by EPS) to 200 (by PE) depending on the indicator used. Most companies classified in the best group in one indicator may not be in the best group classified by other indicators. Only 38 companies, which is named "winners' club" in this research, are classified in the best-performing group by each of the seven indicators. The number increases to 68 and 113 respectively if more than 6 or more than 5 indicators are used to define the superior performance. Table 4-6 lists the 38 companies grouped in the best group by each of the seven indicators. Companies in the winners' club such as Google, IBM, Microsoft, Ebay, Oracle, Adobe, Mcgrew-Hill, and other computer software or systems services providers, are recognized as successful enterprises in their domain.

Table 4-4 Results of Model Fitting (SCI=73xx)

	ROA	ROE	ROIC	PM	MTB	EPS	PE
Group 1							

Intercept	-4.7***	-5.9***	-6.2***	-7.0***	-4.2***	-4.3***	-3.9***
Linear	—	—	0.6**	0.4***	—	—	—
Quadratic	—	—	-0.03*		—	—	—
Eco Growth	-34.7**	10.8	29.3**	-3.0	-4.4	-7.6	4.7
Group 2							
Intercept	-0.4***	-1.3***	-1.7***	-0.5*	-1.1***	-0.7***	-0.6***
Linear	—	—	0.4***	0.7***	—	—	0.3***
Quadratic	—	—	-0.0^{0}***	-0.04***	—	—	-0.02***
Eco Growth	-5.3	25.0***	28.7***	12.1*	16.7**	-0.9	11.0***
Group 3							
Intercept	2.6***	0.58***		-1.2***	-0.8**	1.1***	
Linear	—	—		0.1***	0.8***	0.2***	
Quadratic	—	—		—	-0.05***	—	
Eco Growth	-18.7****	8.6*		7.0***	7.0	7.6	

*p<0.05; **p<0.01; ***p<0.001

Original indicators (group average)	*Trajectory of Performance
	
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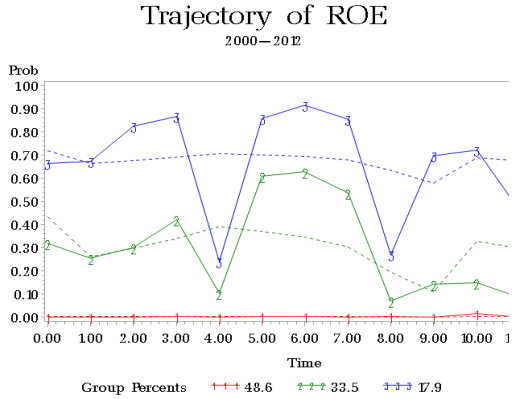

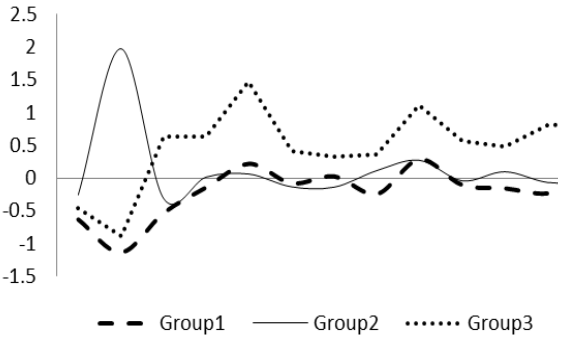

Original indicators (group average)	*Trajectory of Performance
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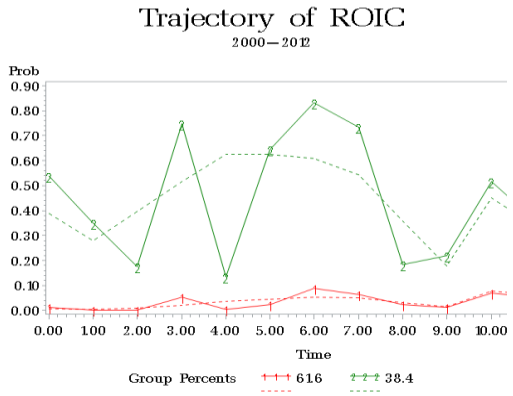	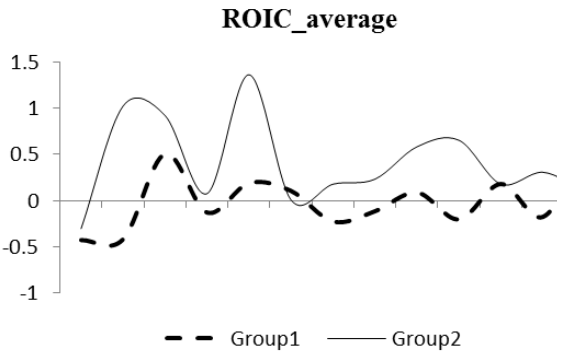
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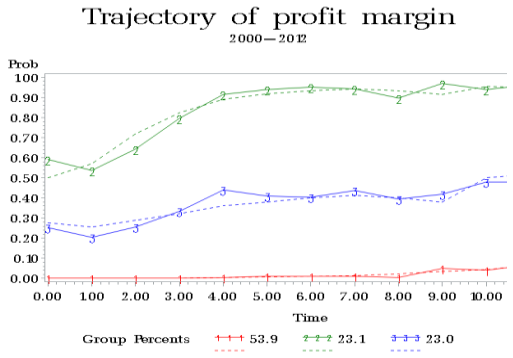	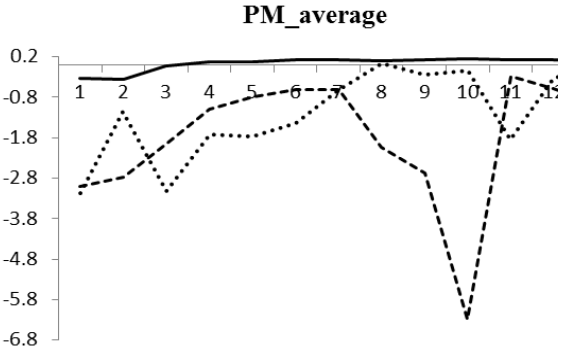
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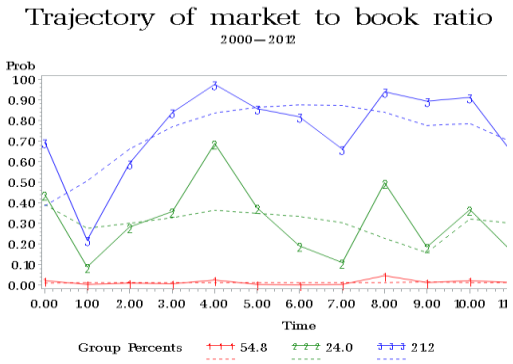	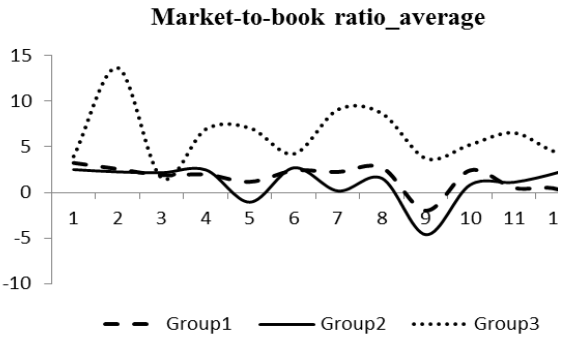
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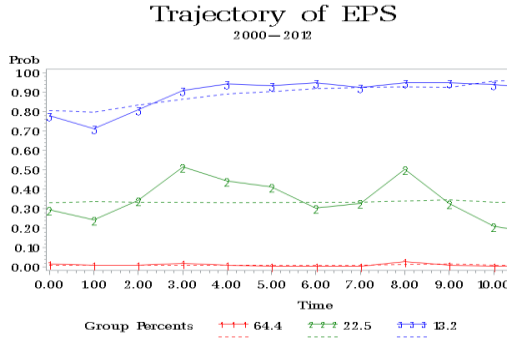
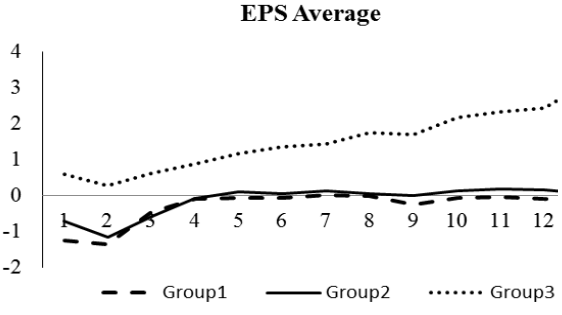
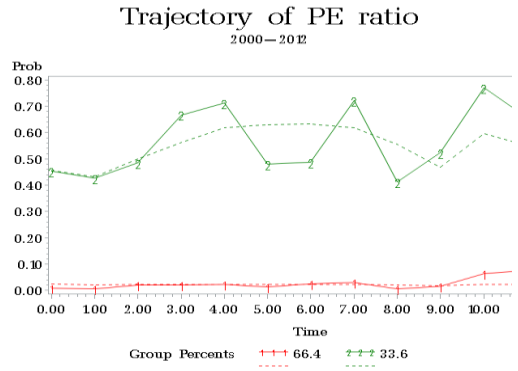
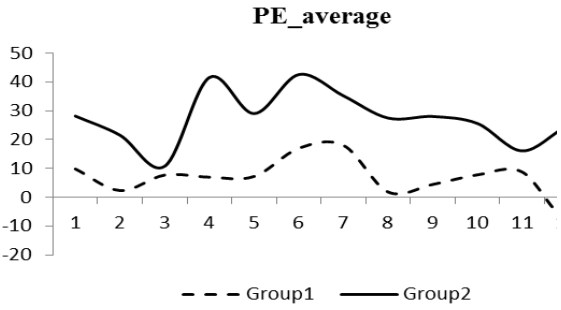
	

Original indicators (group average)	*Trajectory of Performance
(f-1)	(f-2)



(g-1)



(g-2)

* $P\left(Y_i \middle| T_i, j; \beta^j\right) = \prod_{t=i}^{T} P\left(y_{it} \middle| T_i, j; \beta^j\right)$; The firm is defined as superior and assigned a status of 1 if the respective performance indicator is positive and above industry average in the specific year; 0 is assigned otherwise.

Figure 4-3 Trajectories of firm performance with various performance indicators (SIC=73xx)

Table 4-5 Resluts of grouping by trajectories of performance (SIC=73xx)

Indicator	No. of	group percent			Times above average/Year counts		
Groups	Observations.	1	2	3	1	2	3
Return on assets	680	55%	20%	25%*	0.0/ 7.5	3.9/ 10.2	9.8/ 10.9
Return on equity	681	49%	34%	18%*	0.0/ 7.4	3.4/ 10.7	7.2/ 10.1
Return on invested capital	680	62%	38%*		0.2/ 8.0	4.6/ 10.5	
Profit margin	667	54%	23%*	23%	0.1/ 7.5	9.4/ 10.9	4.0/ 10.3
Market-to-book ratio	577	55%	24%*	21%*	0.1/ 7.7	3.4/ 10.8	7.7/ 10.4
Earnings per share	673	64%	23%	13%*	0.1/ 8.0	3.6/ 10.5	10.1/ 11.2
Price-earnings ratio	605	66%	33%*		0.2/ 7.9	6.1/ 11.0	

*The group in which Google is classified.

Table 4-6 Winners' Club (SCI=73xx)

Company	Operation years	Percentage of number of years achieving superior performance						
		ROA	ROE	ROIC	PM	MTB	EPS	PE
Autodesk	12	100%	58%	58%	100%	92%	92%	100%
Automatic data processing	12	100%	75%	58%	100%	92%	100%	67%
DST System	13	100%	92%	54%	100%	77%	100%	31%
IBM	13	100%	92%	85%	100%	100%	100%	54%
Mcgraw-Hill	13	100%	92%	77%	100%	92%	100%	77%
Quality Systems	12	100%	83%	67%	100%	92%	100%	100%
Tyler Technologies	12	92%	77%	46%	92%	69%	92%	92%
Jack Henry & Associates	12	100%	67%	50%	100%	67%	100%	67%
Microsoft	12	100%	92%	83%	100%	100%	100%	50%
Oracle Corp.	12	100%	83%	67%	100%	92%	100%	75%
Adobe System	12	100%	67%	50%	100%	83%	100%	83%
Fiserv Inc.	13	100%	69%	46%	100%	69%	100%	62%
Ebix Inc	12	92%	85%	62%	92%	54%	92%	46%
BMC Software	11	92%	67%	58%	83%	92%	83%	75%
Intuit Inc.	12	100%	75%	58%	92%	92%	92%	75%
National Instruments	13	100%	62%	46%	100%	85%	92%	100%
Citrix Systems	13	100%	62%	38%	100%	85%	100%	100%
Open Text Corp	12	100%	58%	25%	100%	58%	92%	92%
CSG Systems International	13	100%	69%	54%	92%	77%	92%	38%
Ansys Inc.	13	100%	62%	46%	100%	69%	100%	100%
FactSet Research Systems	12	100%	83%	75%	100%	92%	100%	83%
Check Point Software	13	100%	69%	62%	100%	77%	100%	69%
Syntel Inc.	13	100%	85%	85%	100%	92%	100%	69%
Manhattan Associates	13	100%	77%	69%	100%	77%	100%	92%
Microstrategy Inc.	11	85%	69%	69%	77%	77%	77%	31%
Cognizant Technology	13	100%	85%	62%	100%	100%	100%	85%
Ebay Inc.	13	100%	62%	38%	100%	69%	92%	69%
Computer Services Inc.	6	100%	67%	67%	100%	67%	100%	33%
Priceline.com Inc.	11	85%	62%	62%	77%	85%	77%	46%
J2 Global Inc.	11	85%	62%	46%	85%	62%	85%	46%
Global Sources Ltd.	12	92%	69%	46%	92%	77%	85%	46%
Global Payments Inc.	12	100%	75%	67%	100%	73%	100%	83%
Computer Programs and Systems	13	100%	85%	92%	100%	100%	100%	82%

Company	Operation years	Percentage of number of years achieving superior performance						
		ROA	ROE	ROIC	PM	MTB	EPS	PE
Travelzoo Inc.	13	100%	77%	77%	92%	100%	77%	82%
Google	11	100%	73%	64%	100%	89%	100%	89%
Broadridge Financial Solutions	7	100%	71%	57%	100%	80%	100%	50%
Teradata Corp.	8	100%	88%	75%	100%	100%	100%	67%
Blackbaud Inc.	11	100%	64%	64%	91%	100%	82%	89%
Average		99%	80%	63%	99%	87%	99%	72%

4.3 Third Year: Businesses in the Dark Side

In 2000, the two largest firms, in terms of market capitalization, in the world were Cisco and Microsoft. On the top ten list, six (Cisco, Microsoft, Oracle, Intel, IBM and Lucent) of them were technology firms and four of the six had been in existence for 25 years or less. The new technology firms dominating financial markets were the companies that use the internet to deliver products and services. In specific, in the dot-com bubble period, 1998-2000, a great number of new Internet-based companies (commonly referred to as dot-coms) established. The fact that these firms had little in revenues and large operating losses had not deterred investors from bidding up their stock prices and making them worth billions of dollars. The dot-com bubble crash wiped out $5 trillion in market value of technology companies from March 2000 to October 2002. A few large dot-com companies, such as Amazon.com and eBay, survived the turmoil and appear assured of long-term survival, while others such as Google have become industry-dominating mega-firms.

The research interest is to identify the trajectory of performance for firms competing on the axis of error (Powell and Arregle, 2007).

The sample in this research include companies classified in SIC code 7370 (computer programming and data process), 7371 (computer programming services), 7372 (prepackaged software), 7373 (computer integrated system design), 7374 (computer processing and data preparation services), and 7377 (computer rental and leasing). There are 1533 companies included in the Compustat database from 2000 to 2012. The present research deleted companies with any one of the seven indicators smaller than the corresponding mean minus three times standard deviation; 1307 companies are in the final dataset. The descriptive statistics of the dataset are given in Appendix 3.

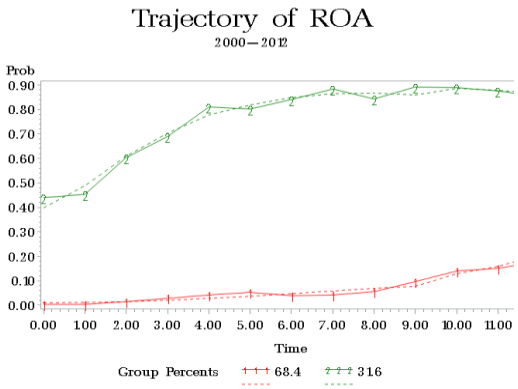
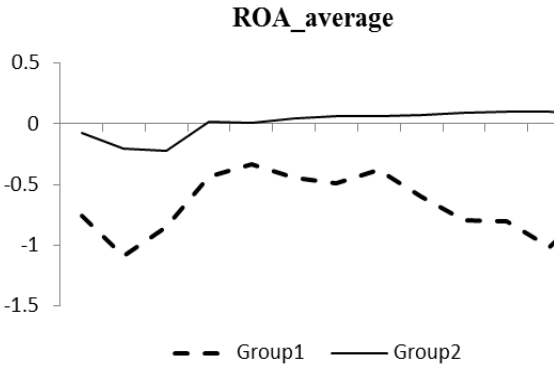
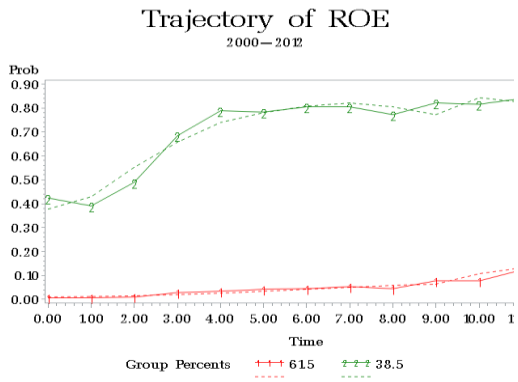
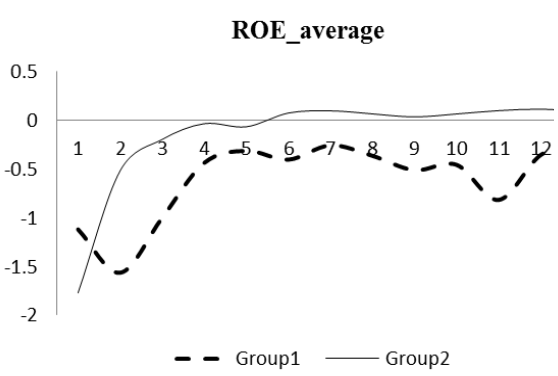
1. Trajectory of groups

The study uses multinomial logit models of trajectory analysis to identify groups and the shapes of the slopes of time-variant performance. Table 4-7 reports the results of the model fit. Figure 4-4 shows the performance trajectories identified by the latent class growth logit model with each of the seven performance indicators. The average data is represented by the solid lines and the predicted trajectories are represented by the dashed lines. The X-axis represents fiscal year and the Y-axis the outcome, that is, the prevalence of superiority of performance during the study period, dichotomously coded as one or zero. The text output is listed in Appendix 3. For each group the intercept parameter is listed first. Second, if there are, the linear, quadratic, and cubic coefficients for time (i.e., year) are presented. Third, the group membership probabilities are listed. A time-invariant variable or risk factor, reason for deletion from the dataset, is included in the model, with 1 represents bankruptcy and 0 otherwise. Lastly, BIC values are shown for the data points and number of subjects. The findings are described below.

Table 4-7 Results of Model Fitting (delisted vs. ongoing)

	ROA	ROE	ROIC	PM	MTB	EPS	PE
Group 1							
Intercept	-4.8***	-4.8***	-6.5***	-3.3***	-4.5***	-3.9***	-4.4***
Linear	0.3	0.3	0.4***	0.3***	0.2***	—	—
Quadratic	—	—	-0.03*	-0.03***	—	—	—
Eco Growth	5,2	6.0	16.9	-5.1	3.5	4.0	-3.6
Group 2							
Intercept	-0.6***	-0.9***	-0.9***	1.0****	-0.9***	0.3***	-1.1***
Linear	0.5***	0.5	0.4***	—	0.5	—	0.3***
Quadratic	-0.02***	-0.02	-0.03***	—	-0.02***	—	-0.02***
Eco Growth	4.4	8.7**	16.4***	-3.4	7,8**	1.7	10.6***

*p<0.05; **p<0.01; ***p<0.001

Original indicators (group average)	*Trajectory of Performance
 (a-1)	 (a-2)
	

Original indicators (group average)	*Trajectory of Performance
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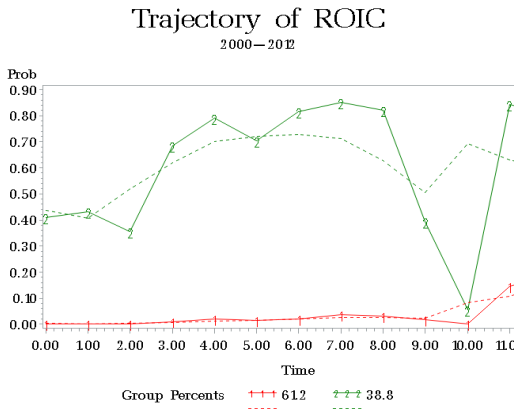	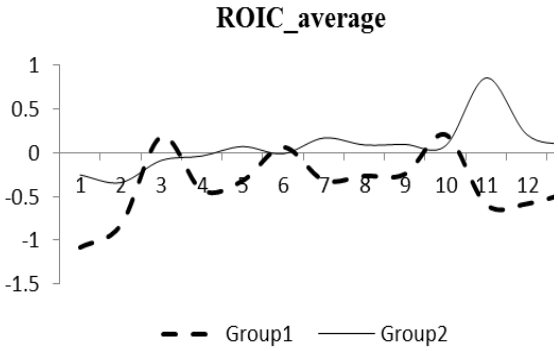
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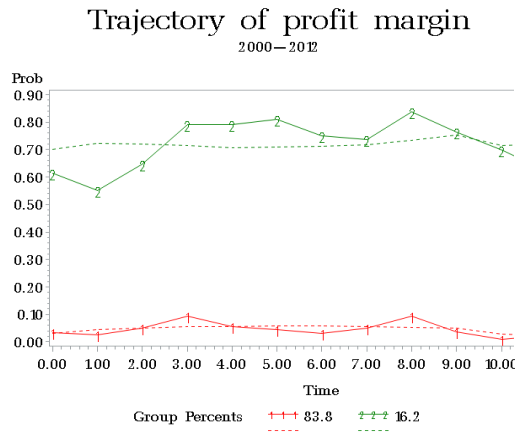	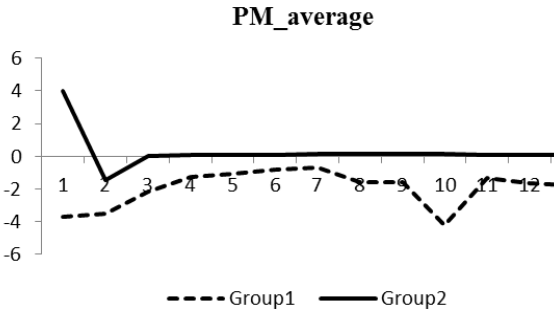
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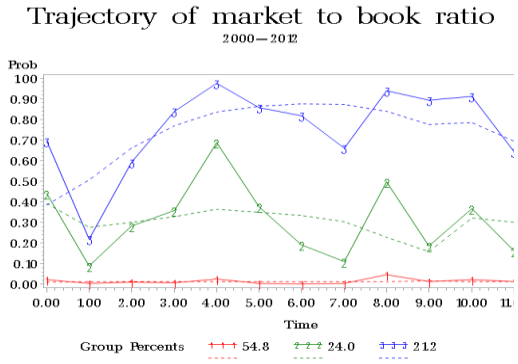	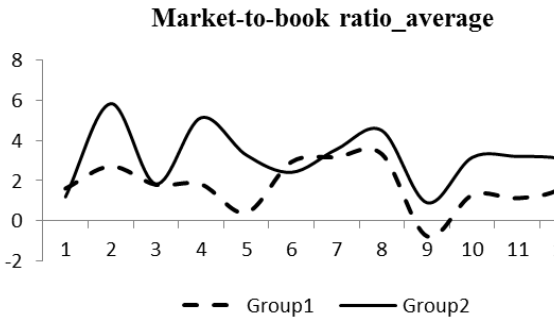
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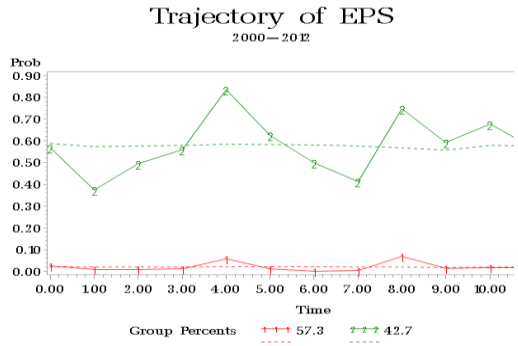
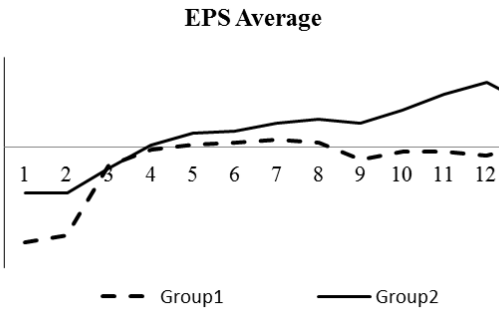
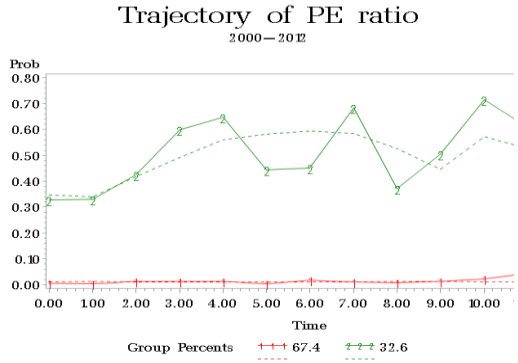
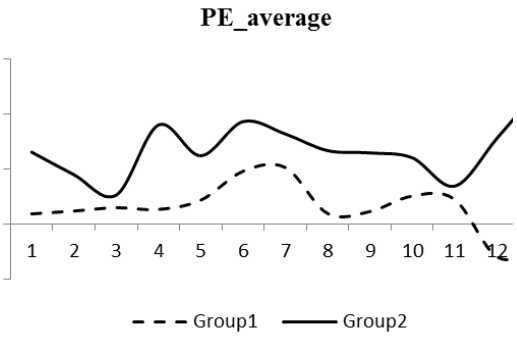
Original indicators (group average)	*Trajectory of Performance
	
(f-1)	(f-2)
	
(g-1)	(g-2)

* $P\left(Y_i \middle| T_i, j; \beta^j\right) = \prod_{t=i}^{T} P\left(y_{it} \middle| T_i, j; \beta^j\right)$; The firm is defined as superior and assigned a status of 1 if the respective performance indicator is positive and above industry average in the specific year; 0 is assigned otherwise.

Figure 4-4 Trajectories of firm performance with various performance indicators (delisted vs. ongoing)

1. The LCGA using the status of superior performance based on ROA identifies two groups, both of which fit a linear pattern with time. Group 1 (68%) have been inferior to the industrial average during the study period. Table 4-8 shows that Group 1 has 0.2 times, out of 4.6 year counts, performing below the industry average. The firms in this group have operated on the axis of error (Powell and Arregle, 2007). As shown in Figure 4-4a-2, the average ROA trajectory of Group 1 has the lowest ROAs over time.
2. The model based on ROE signifies two groups. Group 1 (18%), which performed worse than Group 2, which achieved superior performance 7.2 times out of 10.1 operating years. Group 1 (62%). This group reached above-industry performance only 0.2 times out of the 7.4 operating years in average. Figure 4-4b-2 presents

the trend of ROE of the two groups.

3. The model based on ROIC classifies the sample companies into two groups, both of which fit quadratic shape. Group 1 (61%) has performed inferior to the Group 2 (39%) as Figure 4.3(c-1) shows. Figure 4.4(c-2) illustrates the trajectory of performance of these two groups. Group 1 achieved only 0.1 times out of the 4.3 operation years.
4. The model based on PM identifies two groups, of which, Group 1fits quadratic shape while Group 1's is independent from time. While Group 2 achieved superior performance 7.8 times out of the 9.2 operation years, Group 1 (84%), the inferior performer, reached only 0.8 times out of an average of 4.9 operation years.
5. MTB ratio identifies two groups. The trajectory of Group 1 (66%) is linear while Group 2 (34%) is quadratic. Group 1, the worse, achieved superior performance 0.6 times during the 4.1 operation years. Group 1 (34%) reached only 3.2 times during the 6.3 operation years.
6. EPS signifies two groups. The trajectories of Group 1(57%) and Group 2 (43/%) are both independent from time. Group 1, which performed worse than Group 2, reached superior performance only 0.3 times out of 4.8 operation years.
7. PE ratio identifies two groups. The trajectory of Group 1 is independent from time while that of Group 2 fits a quadratic shape. Group 1, which performed inferior to Group 2, almost has never reached superior performance during an average of 4.4 operation years.

Table 4-8 Resluts of grouping by trajectories of performance (delisted vs. ongoing)

Indicator	No. of	group percent		Average	
Groups	Observations.	1	2	1	2
Return on assets	1305	68%	32%	0.2/4.6	6.4/8.1
Return on equity	1181	62%	38%	0.2/4.6	4.0/5.4
Return on invested capital	1214	61%	39%*	0.1/4.3	4.0/6.3
Profit margin	1297	84%	16%*	0.8/4.9	7.8/9.2
Market-to-book ratio	1293	66%	34%*	0.6/4.1	3.2/6.3
Earnings per share	1114	57%	43%	0.3/4.8	2.4/6.6
Price-earnings ratio	1183	67%	33%*	0.04/4.4	3.3/6.4

Table 4-9 t-test for differentiation of pair groups of failed and non-failed firms

Performance	Non-failures	Failures	t test	Operation	Non-failures	Failures	t test
ROA	0.03	-0.16	7.88***	ART	3.54	7.18	-10.43***
ROE	0.05	-3.89	5.10***	APT	10.94	37.96	-8.21***
ROIC	0.02	-0.07	0.87	INVT	154.06	235.95	-3.19**
PM	0.02	-2.00	2.62*	FAT	26.34	23.01	1.06
MTB	2.54	2.35	0.43	COGS/sales	0.68	1.00	-1.39
EPS	0.87	-0.29	1.78	R&D/sales	0.03	0.60	-2.35*
PE	88.1	15.90	0.93	SG&A/sales	0.26	1.49	-3.64**
				CAPEX/sales	0.01	0.09	-3.38**
				Depreciation	0.03	0.13	-5.45***
				Debt ratio	0.09	1.10	-8.01
				Sales growth	0.07	0.21	-3.65**

***p<0.001; **p<0.01; *p<0.05

2. Failed firms vs. Non-failed firms

Firms that are identified in the worse-performance group by each of the seven indicators are defined as failures while others are non-failures. Table 4-9 shows the t-test for differentiation between the two groups. Each of the mean value of ROA, ROE, and PM significantly differentiates the two groups while ROIC, MTB, EPS, or PE fails to differentiate them. In addition, the accounts receivable turnover, accounts payable turnover, inventory turnover, R&D expenditure to sales, selling, general and

administration to sales, capital expenditure to sales, depreciation to sales, and annual sales growth are all significantly higher than those of the non-failures. The annual sales growth ratio shows the speed of expansion of the firm. The combination of the three turnover ratios measures the period of cash cycle of the firm. The larger the turnover, the shorter the cash cycle is. The ratios of operating expenditures to sales present the effectiveness of cost management of the firm. The results show that while the filed firms have higher annual growth rate and shorter cash cycles than their rivals, they suffer from higher cost pressures. These finding reveal the dilemma in operations in fast growing firms: they made large expenditures on capital and R&D for product innovations and business expansions, however, the high cost to sales and low profit margin made these firms weak in market competition. Firms cannot survive if the firm fails to bring profit margin large enough to recover the capital and $&D expenditures in long time period.

5. CONCLUSTIONS

One of the major objectives of strategic management research is to investigate the sources of competitive advantage. It is essential to identify the firms with sustainable competitive advantage as paradigm to study. This research identifies the trajectory of competitive advantage via observable financial indicators in the semiconductor industry and the software products industry. Firms are defined as superior performers if the annual financial ratios are higher than industry average over a long time period. The LCGA groups firms into classes according the trajectory of the performance for each of the seven financial items. The results show that the groups identified by one financial item are different from those identified by other financial items. I further signify the firms which trajectory is designated to the superior group by each of the seven items. These firms are recognized as winners' club in which all the seven financial items performed above industry average in most years during the study period.

Out of the 145 semiconductor manufacturers, the number of firms that are identified as superior to the rivals ranges from 23 (by PE) to 62 (by ROA) depending on the indicator used. Only 13 companies, including Qualcomm and Intel, are included in the "winners' club". For the software industry, out of the 681 sample firms, the number of firms that are identified as superior to the rivals ranges from 87 (by EPS) to 200 (by PE) depending on the indicator used. Only 38 companies are grouped in the "winners' club" including Google, IBM, Microsoft, Ebay, Oracle, Adobe, Mcgrew-Hill, This research contributes to the strategic management research mainstreams.

This research also examines the trajectory of performance of firms running with competitive disadvantage. Firms that delisted during the study period are failures and they are non-failures otherwise. Among the seven performance indicators, only the mean values of the return on assets, the return on equity, and the profit margin show significant differentiation between the pair groups of failures and non-failures. I further test the differences of configuration related financial variables between the pair groups of failures and non-failures. The findings present that the failed firms are weak in cost management and have problems in recovering the large capital and R&D expenditures although they have short cash-cycle period.

This research contribute to the strategic management research by define the competitive advantage in a dynamic manner. However, some firms failed during expansion but there are firms survive and keep growing. The methodology of this research may be improved if all selected indicators are pooled together to identify the firms with competitive advantage when a multiple-trajectory analysis is available in the future.

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APPENDIX 1 RESULTS OF PROC TRAJ WITH SAS (SCI=3674)

Table A1 Descriptive Statistics

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ROA												
mean	0.04	-0.09	-0.09	-0.05	0.00	0.01	-0.01	-0.01	-0.02	-0.03	0.06	0.03
std	0.18	0.23	0.22	0.23	0.20	0.16	0.41	0.29	0.24	0.18	0.17	0.15
max	0.55	0.42	0.35	0.63	0.58	0.45	0.36	0.31	0.43	0.42	0.33	0.28
min	-0.87	-1.46	-1.21	-1.44	-1.34	-0.49	-4.45	-2.76	-1.30	-1.27	-1.04	-0.67
ROE												
mean	0.04	-0.12	-0.23	-0.18	-0.08	0.01	0.10	0.09	-0.15	-0.07	0.14	-0.02
std	0.30	1.40	0.66	0.62	0.73	0.67	1.02	1.47	0.80	0.62	0.78	0.42
max	0.70	13.38	3.74	1.26	2.28	6.75	10.52	15.23	2.20	4.34	7.61	0.55
min	-1.52	-4.40	-2.47	-4.23	-7.27	-1.69	-1.21	-3.00	-6.27	-2.50	-3.45	-2.54
ROIC												
mean	0.03	-0.06	-0.07	-0.05	-0.03	-0.01	0.05	0.03	-0.10	-0.02	0.08	0.02
std	0.22	0.92	0.50	0.67	0.38	0.23	0.78	0.45	0.57	0.38	0.21	0.31
max	0.68	9.25	4.68	5.78	0.85	0.54	8.46	4.56	1.08	3.21	0.97	1.67
min	-1.07	-2.60	-1.52	-3.43	-3.51	-0.99	-2.40	-0.98	-4.03	-1.14	-0.66	-1.75
PM												
mean	-0.10	-0.50	-0.55	-0.17	-0.10	-0.06	-0.09	-0.09	-0.54	-0.13	0.11	0.05
std	0.75	1.27	1.24	0.44	0.71	0.43	0.92	0.64	3.52	0.39	0.77	0.21
max	0.44	0.31	1.79	0.41	0.81	0.57	0.44	0.61	0.42	0.43	8.34	0.80
min	-6.08	-10.84	-6.88	-2.36	-7.34	-3.28	-9.61	-5.28	-38.65	-2.74	-1.48	-0.76
MTB												
mean	3.44	3.96	1.79	3.68	3.04	2.90	2.59	5.11	1.67	2.19	2.68	-1.51
std	2.96	7.55	1.90	3.72	2.82	1.99	3.29	16.48	2.33	1.56	2.04	32.69
max	15.33	72.4	8.30	22.31	18.97	7.96	10.99	163.42	18.24	7.89	11.02	8.28
min	0.32	-4.52	-6.92	-4.80	-2.40	-5.72	-21.77	-5.09	-1.96	-2.07	-4.07	-309.63
EPS												
mean	0.37	-0.90	-0.94	-0.59	0.09	0.15	0.26	0.32	-0.35	-0.07	0.75	0.47
std	1.59	1.89	2.61	3.12	0.91	0.78	0.77	0.99	1.65	1.16	1.37	1.15
max	9.22	1.41	8.67	3.51	3.43	3.18	4.80	5.67	4.34	7.67	8.06	5.25
min	-3.13	-10.79	-16.44	-31.64	-3.85	-2.55	-1.16	-2.09	-6.39	-3.42	-2.27	-3.25
PE												
mean	0.37	-0.90	-0.94	-0.59	0.09	0.15	0.26	0.32	-0.35	-0.07	0.75	0.47
std	50.57	262.18	43.29	88.67	76.83	85.05	168.76	113.26	40.46	92.91	42.90	36.49
max	319.32	2623.0	292.00	311.2	656.00	745.0	1479.0	1103.0	331.3	749.00	346.5	257.33
min	-73.61	-531.50	-138.67	-534.00	-209.00	-260.25	-385.50	-169.64	-159.00	-128.25	-104.20	-73.39

The SAS System

Trajectory of ROA (SIC=3674)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-3.29446	0.40194	-8.196	0.0000
	Linear	0.14338	0.04419	3.244	0.0012
	G2000	12.87223	8.96971	1.435	0.1515
2	Intercept	0.95528	0.29434	3.245	0.0012
	Linear	0.06753	0.03372	2.002	0.0454
	G2000	7.71642	5.92715	1.302	0.1932
	Group membership				
1	(%)	56.52040	4.37117	12.930	0.0000
2	(%)	43.47960	4.37117	9.947	0.0000

BIC= -680.46 (N=1428) BIC= -672.45 (N=145) AIC= -662.03 L= -655.03

Trajectory of ROE (SIC=3674)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-7.69395	1.94439	-3.957	0.0001
	G2000	127.27776	53.41467	2.383	0.0173
2	Intercept	-0.44001	0.16304	-2.699	0.0070
	G2000	-3.87103	5.16211	-0.750	0.4534
3	Intercept	1.51040	0.24776	6.096	0.0000
	G2000	4.79753	7.90302	0.607	0.5439
	Group membership				
1	(%)	39.15962	4.42567	8.848	0.0000
2	(%)	36.69810	4.99743	7.343	0.0000
3	(%)	24.14228	4.63428	5.209	0.0000

BIC= -741.23 (N=1428) BIC= -732.08 (N=145) AIC= -720.17 L= -712.17

Trajectory of ROIC (SIC=3674)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-2.05347	0.40405	-5.082	0.0000
	Linear	-0.30861	0.12647	-2.440	0.0148
	Quadratic	0.03715	0.00969	3.834	0.0001
	G2000	5.78122	7.16657	0.807	0.4200
2	Intercept	0.80080	0.34849	2.298	0.0217
	Linear	0.24803	0.11145	2.225	0.0262
	Quadratic	-0.01792	0.00878	-2.040	0.0415
	G2000	4.66427	6.04765	0.771	0.4407
	Group membership				
1	(%)	58.92104	4.21644	13.974	0.0000
2	(%)	41.07896	4.21644	9.743	0.0000

BIC= -704.82 (N=1427) BIC= -694.53 (N=145) AIC= -681.14 L= -672.14

Trajectory of PM (SIC=3674)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.27090	0.94764	-4.507	0.0000
	G2000	27.87899	34.77688	0.802	0.4229
2	Intercept	-0.29978	0.15063	-1.990	0.0468
	G2000	10.82076	5.05124	2.142	0.0323
3	Intercept	2.34528	0.38000	6.172	0.0000
	G2000	8.03725	12.24030	0.657	0.5115
	Group membership				
1	(%)	42.66307	4.39299	9.712	0.0000
2	(%)	37.26809	4.65177	8.012	0.0000
3	(%)	20.06884	3.95803	5.070	0.0000

BIC= -706.34 (N=1427) BIC= -697.19 (N=145) AIC= -685.29 L= -677.29

Trajectory of Market to Book Ratio (SIC=3674)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-3.65114	0.43074	-8.476	0.0000
	Linear	0.15168	0.04902	3.094	0.0020
	G2000	2.52125	8.50633	0.296	0.7670
2	Intercept	1.05830	0.16760	6.315	0.0000
	G2000	-0.15681	6.60682	-0.024	0.9811
	Group membership				
1	(%)	69.93034	4.40146	15.888	0.0000
2	(%)	30.06966	4.40146	6.832	0.0000

BIC= -486.35 (N=1144) BIC= -479.51 (N=117) AIC= -471.22 L= -465.22

Trajectory of EPS (SIC=3674)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-2.49968	0.31339	-7.976	0.0000
	Linear	0.08684	0.03358	2.586	0.0098
	G2000	1.08543	6.44558	0.168	0.8663
2	Intercept	1.11977	0.17675	6.335	0.0000
	G2000	3.13308	5.90478	0.531	0.5958
	Group membership				
1	(%)	66.96575	4.51853	14.820	0.0000
2	(%)	33.03425	4.51853	7.311	0.0000

BIC= -718.52 (N=1411) BIC= -711.65 (N=143) AIC= -702.76 L= -696.76

Trajectory of PE ratio (SIC=3674)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-3.45904	0.55907	-6.187	0.0000
	G2000	16.30144	17.24321	0.945	0.3446
2	Intercept	-0.89057	0.27556	-3.232	0.0013
	G2000	18.92854	8.39041	2.256	0.0242
3	Intercept	1.86613	0.47006	3.970	0.0001
	G2000	-45.83218	16.65169	-2.752	0.0060
	Group membership				
1	(%)	52.79590	6.46731	8.164	0.0000
2	(%)	30.05591	6.16769	4.873	0.0000
3	(%)	17.14819	3.95602	4.335	0.0000

BIC= -662.68 (N=1303) BIC= -653.61 (N=135) AIC= -641.99 L= -633.99

APPENDIX 2 RESULTS OF PROC TRAJ WITH SAS (SCI=73xx)

Descriptive Statistics

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ROA												
mean	-0.62	-0.86	-0.83	-0.30	-0.22	-0.26	-0.27	-0.17	-0.27	-0.33	-0.31	-0.35
std	2.07	3.75	5.39	1.39	0.91	2.20	1.83	1.23	2.02	2.18	2.06	2.34
max	0.76	0.67	0.65	0.74	0.56	5.18	1.50	0.74	0.65	0.63	1.43	0.92
min	-30.87	-74.57	-110.00	-16.52	-10.99	-47.92	-34.62	-21.38	-38.44	-31.36	-27.00	-30.80
ROE												
mean	-0.58	-0.24	-0.34	0.03	0.36	0.00	-0.04	0.04	0.40	0.17	0.15	0.22
std	5.31	20.15	3.59	2.25	4.39	3.10	3.26	1.69	4.50	2.54	3.84	3.13
max	83.96	479.75	66.78	32.83	71.66	53.13	22.83	26.72	62.10	26.15	41.60	50.26
min	-65.18	-110.95	-19.66	-13.56	-13.04	-34.02	-61.46	-12.30	-20.09	-32.07	-48.24	-9.95
ROIC												
mean	-0.43	0.10	0.45	-0.05	0.60	0.07	-0.04	0.05	0.32	0.26	0.11	0.15
std	3.93	10.47	12.01	2.16	7.68	4.52	2.38	1.14	3.26	4.23	2.61	3.22
max	66.70	243.33	295.53	32.07	121.14	87.81	13.85	12.67	45.68	83.33	39.95	49.95
min	-41.27	-31.62	-15.39	-15.96	-17.70	-34.45	-45.96	-7.78	-11.82	-22.59	-22.40	-20.81
PM												
mean	-2.71	-3.25	-1.92	-0.99	-0.85	-0.62	-0.50	-1.27	-1.05	-2.75	-0.89	-1.06
std	20.92	19.40	14.10	5.99	5.95	4.53	3.36	10.99	8.65	32.17	10.16	8.09
max	414.23	77.19	1.69	2.04	20.03	2.88	3.18	23.33	3.18	1.49	46.47	1.70
min	-239.08	-323.53	-218.25	-96.86	-107.71	-92.49	-44.62	-155.06	-157.29	-609.00	-195.63	-135.81
MTB												
mean	1.47	6.73	2.33	2.80	1.43	2.71	3.24	3.93	-0.98	2.25	2.13	3.12
std	17.48	68.66	14.98	13.94	22.33	8.64	18.09	10.05	27.26	18.16	16.82	34.81
max	64.21	1513.0	334.03	198.38	84.55	72.74	281.98	130.94	79.73	192.41	119.69	454.30
min	-283.52	-127.21	-76.86	-104.07	-348.10	-61.20	-91.52	-46.95	-428.20	-210.64	-137.42	-226.22
EPS												
mean	-1.31	-1.27	-0.30	0.00	0.12	0.17	0.26	0.29	0.15	0.37	0.59	0.74
std	3.05	3.43	2.95	1.28	0.98	1.11	1.17	1.33	1.42	1.65	4.84	7.16
max	4.58	5.58	68.15	23.75	10.48	7.61	11.80	14.38	13.46	20.62	99.79	147.07
min	-30.67	-39.55	-9.40	-4.50	-4.64	-8.29	-3.77	-6.43	-5.43	-4.26	-4.81	-13.98
PE												
mean	-1.31	-1.27	-0.30	0.00	0.12	0.17	0.26	0.29	0.15	0.37	0.59	0.74
std	85.88	67.90	39.95	186.23	68.98	128.19	103.06	77.25	141.63	63.41	152.99	65.17
max	1318.75	934.00	458.25	4170.0	851.00	1893.0	1233.0	703.00	2766.0	588.00	2765.0	562.00
min	-331.25	-242.00	-147.25	-409.00	-369.33	-217.50	-222.00	-441.00	-278.00	-170.82	-384.57	-312.00

The SAS System

Trajectory of ROA (SCI=73xx)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.68980	0.43275	-10.837	0.0000
	G2000	-34.66908	14.55681	-2.382	0.0173
2	Intercept	-0.37985	0.10966	-3.464	0.0005
	G2000	-5.29934	3.32384	-1.594	0.1109
3	Intercept	2.56123	0.16633	15.399	0.0000
	G2000	-18.67679	5.71254	-3.269	0.0011
	Group membership				
1	(%)	54.80505	2.08174	26.327	0.0000
2	(%)	19.96983	1.80382	11.071	0.0000
3	(%)	25.22512	1.85786	13.578	0.0000

BIC= -2242.92 (N=6053) BIC= -2234.18 (N=680) AIC= -2216.09 L= -2208.09

Trajectory of ROE (SCI=73xx)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-5.87928	0.93858	-6.264	0.0000
	G2000	10.77080	29.53033	0.365	0.7153
2	Intercept	-1.30951	0.12374	-10.583	0.0000
	G2000	24.96027	3.73626	6.681	0.0000
3	Intercept	0.58096	0.13800	4.210	0.0000
	G2000	8.58605	4.08472	2.102	0.0356
	Group membership				
1	(%)	48.55038	2.23957	21.678	0.0000
2	(%)	33.51460	2.58438	12.968	0.0000
3	(%)	17.93502	2.43395	7.369	0.0000

BIC= -2832.19 (N=6073) BIC= -2823.44 (N=681) AIC= -2805.35 L= -2797.35

Trajectory of ROIC (SCI=73xx)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-6.20506	0.78988	-7.856	0.0000
	Linear	0.59179	0.21399	2.766	0.0057
	Quadratic	-0.02908	0.01443	-2.015	0.0439
	G2000	29.33962	10.56398	2.777	0.0055
2	Intercept	-1.66165	0.15623	-10.636	0.0000
	Linear	0.43490	0.04686	9.281	0.0000
	Quadratic	-0.03574	0.00364	-9.826	0.0000
	G2000	28.70578	2.79927	10.255	0.0000
	Group membership				
1	(%)	61.63902	2.23955	27.523	0.0000
2	(%)	38.36098	2.23955	17.129	0.0000

BIC= -2597.93 (N=6068) BIC= -2588.08 (N=680) AIC= -2567.73 L= -2558.73

Trajectory of PM (SCI=73xx)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-6.99690	0.82857	-8.445	0.0000
	Linear	0.40050	0.08662	4.624	0.0000
	G2000	-3.02003	11.32225	-0.267	0.7897
2	Intercept	-0.50732	0.23478	-2.161	0.0307
	Linear	0.68842	0.09207	7.477	0.0000
	Quadratic	-0.03611	0.00848	-4.259	0.0000
	G2000	12.05962	5.52920	2.181	0.0292
3	Intercept	-1.24896	0.21064	-5.929	0.0000
	Linear	0.10879	0.02037	5.340	0.0000
	G2000	6.96264	3.55522	1.958	0.0502
	Group membership				
1	(%)	53.90977	2.28140	23.630	0.0000
2	(%)	23.10227	2.05359	11.250	0.0000
3	(%)	22.98797	2.07607	11.073	0.0000

BIC= -2337.51 (N=5940) BIC= -2324.39 (N=667) AIC= -2297.37 L= -2285.37

Trajectory of Market-to-book ratio (SCI=73xx)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.23137	0.42007	-10.073	0.0000
	G2000	-4.42626	16.71163	-0.265	0.7911
2	Intercept	-1.14778	0.17315	-6.629	0.0000
	G2000	16.77649	5.26351	3.187	0.0014
3	Intercept	-0.75717	0.23939	-3.163	0.0016
	Linear	0.76566	0.08554	8.951	0.0000
	Quadratic	-0.05766	0.00668	-8.633	0.0000
	G2000	7.00345	4.57132	1.532	0.1256
	Group membership				
1	(%)	54.78138	2.61703	20.933	0.0000
2	(%)	24.00726	2.47576	9.697	0.0000
3	(%)	21.21136	2.17915	9.734	0.0000

BIC= -2222.02 (N=5168) BIC= -2211.06 (N=577) AIC= -2189.27 L= -2179.27

Trajectory of EPS (SCI=73xx)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.33762	0.35822	-12.109	0.0000
	G2000	-7.63655	10.99612	-0.694	0.4874
2	Intercept	-0.66891	0.10786	-6.202	0.0000
	G2000	-0.94148	3.19388	-0.295	0.7682
3	Intercept	1.10467	0.31569	3.499	0.0005
	Linear	0.18125	0.04938	3.671	0.0002
	G2000	7.52095	7.69953	0.977	0.3287
	Group membership				
1	(%)	64.36463	2.34854	27.406	0.0000
2	(%)	22.45198	2.10158	10.683	0.0000
3	(%)	13.18338	1.39878	9.425	0.0000

BIC= -2042.82 (N=6003) BIC= -2032.98 (N=673) AIC= -2012.67 L= -2003.67

Trajectory of PE ratio (SCI=73xx)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-3.86587	0.25129	-15.384	0.0000
	G2000	4.71005	8.42475	0.559	0.5761
2	Intercept	-0.63753	0.15718	-4.056	0.0001
	Linear	0.25520	0.04844	5.268	0.0000
	Quadratic	-0.01786	0.00376	-4.754	0.0000
	G2000	10.98902	2.58761	4.247	0.0000
	Group membership				
1	(%)	66.44729	2.07173	32.073	0.0000
2	(%)	33.55271	2.07173	16.196	0.0000

BIC= -2221.57 (N=5396) BIC= -2213.91 (N=605) AIC= -2198.49 L= -2191.49

APPENDIX 3 RESULTS OF PROC TRAJ WITH SAS (Failures vs. Non-failures)

Descriptive Statistics

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ROA												
mean	724.00	-0.92	-1.12	-0.71	-0.23	-0.26	0.00	-0.51	-0.27	-0.35	-0.47	-0.78
std	39.90	2.69	3.34	3.27	0.86	0.92	0.00	1.90	1.03	1.22	2.31	3.37
max	156.83	0.39	0.67	0.56	0.74	0.37	0.00	0.85	0.63	0.65	0.63	1.43
min	1330.99	-30.87	-42.43	-45.24	-7.69	-7.32	0.00	-6.43	-6.44	-5.87	-18.50	-27.00
ROE												
mean	-0.51	-1.82	-1.55	-0.98	-0.40	-0.63	0.00	0.23	-0.06	-0.35	0.02	-0.72
std	1.73	6.05	2.95	2.70	1.38	2.02	0.00	0.54	0.67	1.50	0.54	4.82
max	0.49	4.99	2.27	7.96	1.43	2.94	0.00	1.47	1.57	1.76	2.15	3.16
min	-12.36	-75.74	-19.06	-19.66	-11.10	-13.04	0.00	-0.66	-1.79	-7.40	-1.95	-48.24
ROIC												
mean	-0.30	-1.22	-0.99	-0.47	-0.32	-0.39	0.00	0.25	-0.01	-0.15	-0.04	1.09
std	1.15	3.69	1.82	1.43	1.10	0.96	0.00	0.52	0.85	1.05	0.67	18.75
max	1.93	1.13	0.97	6.58	1.68	0.58	0.00	1.51	3.21	1.80	2.06	215.71
min	-6.65	-41.27	-13.97	-11.62	-7.87	-4.67	0.00	-0.91	-2.47	-6.51	-3.60	-22.40
PM												
mean	-0.16	-3.31	-4.84	-1.45	-0.70	-0.60	0.00	-3.70	-6.42	-1.51	-3.88	-1.21
std	0.71	27.73	27.14	7.39	2.82	5.16	0.00	11.13	22.83	6.47	30.09	6.98
max	1.14	414.23	77.19	1.14	2.04	20.03	0.00	0.73	0.45	0.53	0.54	1.74
min	-4.42	-239.08	-323.53	-105.65	-22.75	-40.21	0.00	-37.18	-114.27	-48.00	-307.45	-69.33
MTB												
mean	-2.85	0.05	1.79	1.42	2.30	3.79	0.00	17.35	8.73	-7.32	-2.90	0.25
std	15.44	22.43	7.26	3.88	5.59	7.60	0.00	43.26	29.87	44.08	38.47	32.75
max	29.56	64.2	72.55	36.52	16.04	38.67	0.00	105.49	130.94	22.23	87.42	119.69
min	-153.80	-283.52	-38.97	-11.15	-37.27	-10.24	0.00	-3.71	-6.57	-238.94	-210.64	-137.42
EPS												
mean	0.66	-1.73	-1.61	-0.37	-0.03	-0.08	0.00	0.19	0.08	-0.15	0.09	0.61
std	28.70	3.24	3.84	4.88	2.23	0.89	0.00	0.85	0.76	1.12	0.80	7.82
max	90.08	2.39	5.58	68.15	23.75	4.07	0.00	2.07	2.64	2.71	2.96	99.79

PE	min	-181.72	-28.92	-38.25	-9.21	-4.50	-3.17	0.00	-2.04	-1.57	-5.43	-3.46	-4.68
	mean	0.66	-1.73	-1.61	-0.37	-0.03	-0.08	0.00	0.19	0.08	-0.15	0.09	0.61
	std	0.78	44.02	65.89	38.17	99.34	59.25	0.00	50.05	23.84	16.30	42.86	59.04
	max	5.35	604.2	688.67	403.0	965.00	100.0	0.0	133.5	57.1	26.90	190.6	143.72
	min	-3.32	-331.25	-106.00	-55.00	-344.00	-369.33	0.00	-5.14	-62.50	-78.55	-35.22	-302.83

Trajectory of ROA (SCI=73xx axis of error)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.83618	0.25519	-18.951	0.0000
	Linear	0.28011	0.02569	10.902	0.0000
	G2000	5.21991	4.78653	1.091	0.2755
2	Intercept	-0.59483	0.14980	-3.971	0.0001
	Linear	0.53271	0.05164	10.316	0.0000
	Quadratic	-0.02792	0.00425	-6.571	0.0000
	G2000	4.44367	3.01941	1.472	0.1411
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	0.05446	0.08898	0.612	0.5405
	result	-20.93736	1651.54114	-0.013	0.9899

BIC= -2609.71 (N=7324) BIC= -2601.94 (N=1305) AIC= -2578.66 L= -2569.66

Trajectory of ROE (SCI=73xx axis of error)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.83063	0.30614	-15.779	0.0000
	Linear	0.25756	0.03104	8.298	0.0000
	G2000	5.99345	6.06468	0.988	0.3231
2	Intercept	-0.86950	0.14599	-5.956	0.0000
	Linear	0.51468	0.04814	10.692	0.0000
	Quadratic	-0.02819	0.00390	-7.227	0.0000
	G2000	8.65652	2.66861	3.244	0.0012
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	0.51666	0.12033	4.294	0.0000
	result	-21.85736	2124.34677	-0.010	0.9918

BIC= -2460.76 (N=6407) BIC= -2453.15 (N=1181) AIC= -2430.32 L= -2421.32

Trajectory of ROIC (SCI=73xx axis of error)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-6.63608	0.50063	-13.255	0.0000
	Linear	0.38286	0.04780	8.010	0.0000
	G2000	16.91596	9.78426	1.729	0.0839
2	Intercept	-0.93935	0.13620	-6.897	0.0000
	Linear	0.41556	0.04272	9.727	0.0000
	Quadratic	-0.02802	0.00334	-8.400	0.0000
	G2000	16.37834	2.23068	7.342	0.0000
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	0.53720	0.10965	4.899	0.0000
	result	-21.87319	2101.33656	-0.010	0.9917

BIC= -2648.59 (N=6624) BIC= -2640.96 (N=1214) AIC= -2618.00 L= -2609.00

Trajectory of PM (SCI=73xx axis of error)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-3.25220	0.20768	-15.660	0.0000
	Linear	0.26853	0.07648	3.511	0.0004
	Quadratic	-0.02823	0.00737	-3.829	0.0001
	G2000	-5.14324	4.51033	-1.140	0.2542
2	Intercept	1.00013	0.09426	10.611	0.0000
	G2000	-3.44546	3.11513	-1.106	0.2687
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	-1.03238	0.09603	-10.751	0.0000
	result	-20.45321	2137.05101	-0.010	0.9924

BIC= -2468.99 (N=7290) BIC= -2462.08 (N=1297) AIC= -2441.41 L= -2433.41

Trajectory of Market-to-Book Ratio (SCI=73xx axis of error)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.55136	0.26191	-17.377	0.0000
	Linear	0.24168	0.02685	9.001	0.0000
	G2000	3.46858	4.99689	0.694	0.4876
2	Intercept	-0.85672	0.14102	-6.075	0.0000
	Linear	0.47237	0.04713	10.023	0.0000
	Quadratic	-0.02419	0.00383	-6.311	0.0000
	G2000	7.76431	2.61526	2.969	0.0030
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	0.18553	0.10314	1.799	0.0721
	result	-21.45962	2035.07090	-0.011	0.9916

BIC= -2805.05 (N=7212) BIC= -2797.31 (N=1293) AIC= -2774.07 L= -2765.07

Trajectory of EPS (SCI=73xx axis of error)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-3.91424	0.27391	-14.290	0.0000
	G2000	4.04992	9.46253	0.428	0.6687
2	Intercept	0.27761	0.06209	4.471	0.0000
	G2000	1.65448	2.16317	0.765	0.4444
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	0.81922	0.11961	6.849	0.0000
	result	-15.59771	78.98772	-0.197	0.8435

BIC= -2636.49 (N=6204) BIC= -2631.33 (N=1114) AIC= -2616.29 L= -2610.29

Trajectory of PE ratio (SCI=73xx axis of error)

Maximum Likelihood Estimates
Model: Logistic (LOGIT)

Group	Parameter	Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
1	Intercept	-4.35458	0.29717	-14.654	0.0000
	G2000	-3.58743	9.84659	-0.364	0.7156
2	Intercept	-1.08084	0.14610	-7.398	0.0000
	Linear	0.32271	0.04481	7.202	0.0000
	Quadratic	-0.02111	0.00345	-6.115	0.0000
	G2000	10.58199	2.41436	4.383	0.0000
	Group membership				
1	Constant	(0.00000)	.	.	.
2	Constant	0.12238	0.11262	1.087	0.2772
	result	-21.20288	1920.52151	-0.011	0.9912

BIC= -2399.10 (N=6553) BIC= -2392.26 (N=1183) AIC= -2371.95 L= -2363.95

附件四

國科會補助專題研究計畫項下出席國際學術會議心得報告

日期:102 年 7 月 6 日

計畫編號	NSC 99－ 2410 － H － 264 － 001 － MY3		
計畫名稱	競爭異質性軌跡之研究－動態資源構形模型		
出國人員姓名	劉芬美	服務機構及職稱	致理技術學院
會議時間	102 年 7 月 1 日至 102 年 7 月 4 日	會議地點	希臘雅典
會議名稱	(中文) 第 11 屆國際財務研討會 (英文)11th Annual International Conference on Finance, 1-4 July 2013, Athens, Greece		
發表論文題目	(中文) 不確定下之計畫組合評價 (英文) Valuation of Project Portfolio under Uncertainty		

一、參加會議經過

本研討會於 2013 年 7 月 1-4 日於希臘雅典舉行,本計畫主持人之論文被接受後,安排於 7 月 1 日下午 15:30 時進行口頭發表,其餘時間則參與其他學者之發表,並參與學術交流活動。由於 7/5 返程班機已滿,無法訂位,爰提前一天於 7/4 返國。

二、與會心得

本研討會包括來自世界二十餘國之學者與會,涵蓋領域包括財務會計、行銷及一般管理,在財務會計領域方面,又細分為「盈餘及財務績效」、「衍生性金融商品及避險」、「國家區域分析」、「審計及準則」、「會計實務」、「公司治理」、「市場變動與共變」。

除學術交流外，另外觀察之心得是，此次研討會有許多至先進國家研修博士之中國大陸籍學生，以就學之學校名義發表論文，研究中國大陸之議題，在研究主題及簡報技巧上，表現非常優秀，獲得在場外籍學者讚賞。甚至許多先進國家學者，也是引用其中國學生處理資料為基礎，發表與中國有關研究主題之論文。相對而言，台灣學者之人數及發表篇數均較少，且由於缺乏長期國外語言訓練機會，在表達上較中國學生弱勢許多。

三、考察參觀活動(無是項活動者略)

四、建議

多鼓勵學者參加此類國際學術活動，累積經驗，除讓語言表達上更順暢外，並加強肢體語言的訓練，簡報時更具說服力。

五、攜回資料名稱及內容

1.接受函及邀請函

2.參與學者發表之論文目錄

3.會議議程

4.發表論文

5.簡報資料

六、其他

ATHENS INSTITUTE FOR EDUCATION AND RESEARCH
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Email: atiner@atiner.gr URL: www.atiner.gr

Athens, 30 May 2013

Fenmay Liou
Department of Finance, Chihlee Institute of Technology, New Taipei City, Taiwan,

Borliang Chen
Department of Civil Engineering & Disaster Prevention, National United University, Miaoli, Taiwan,

Our Ref: FIN2013/3714062

Dear Colleagues,

I would like to inform you that the selection committee has decided to invite you to speak at our **11th Annual International Conference on Finance,** 1-4 July 2013, Athens, Greece on the topic of:

Valuation Model of Project Portfolio under Uncertainty

Please be prepared for an **oral presentation** of 15-20 minutes including discussion and visit the conference website: http://www.atiner.gr/finance.htm for more information. Confirm your participation by completing and sending the registration form **before 17 June 2013** by fax, regular mail or email. The registration form can be downloaded from (http://www.atiner.gr/2013/REG-FIN.doc). For your convenience, a special conference rate has been arranged with a hotel. Please complete the registration form for the nights you want accommodation for. Reservations should be made as soon as possible as the offer only stands as long as rooms are available. The name of the hotel will be announced 1-2 weeks before the conference. ATINER will select one of the hotels available on the following list: http://www.atiner.gr/docs/Hotels_List.htm. If you need more information on the accommodation please send us an email (not to the hotel itself) at hotel@atiner.gr.

The conference's social program is available at http://www.atiner.gr/2013/SOC-FIN.htm. These academic events give the opportunity to our conference participants to further discuss the issues developed during the formal sessions and establish academic collaborations with other scholars from many different countries.

If you want your paper to be considered (peer reviewed) for publication**,** please submit your manuscript by **17 June 2013** following the paper guidelines, which can be downloaded from: http://www.atiner.gr/docs/Paper_Guidelines.htm. **Papers cannot exceed 5000 words (everything included) and must be sent by email only.** For more information, please see our abstract and paper publication policy at http://www.atiner.gr/docs/Publication_Policy.htm. Please, do not fax your paper. In addition to your paper being considered for publication, the Institute publishes an abstract book with an ISBN number and a Conference Paper Series with an ISSN number. The last two publications come out immediately after the conference.

Please support ATINER by asking your library to order our publications from previous conferences, either as books or selected conference proceedings. Visit our publications website for contents and order forms (http://www.atiner.gr/docs/BOOK_PUBLICATIONS.htm).

I look forward to meeting you in Athens.

Sincerely,

Dr. Gregory T. Papanikos
President

11th Annual International Conference on Business: Accounting-Finance-Management-Marketing, 1-4 July 2013, Athens, Greece

Provisional List of Papers Accepted and Registered to be Presented (Listed by Presenter's Surname) and Other Attendees

Note: This list includes only those who have paid the registration fee, neither the accepted ones nor the ones that have sent their registration form. The list will be updated weekly. Date of this list: 25th of June 2013

1. Burcu Eker Akgoz, Lecturer, Bahcesehir University, Turkey & Elif Engin, Instructor, Bahcesehir University, Turkey. The History of Corporate Social Responsibility in Turkey: Analysis of Koç Holding and Sabancı Holding's Social Responsibility Practices. (Management) (Monday 1 July 2013)
2. Ijaz Ali, PhD Student, CERAG Research Laboratory, University of Grenoble, France. Appearance and Disappearance of Dividends: Evidence from Europe. (Finance)
3. Dr Hamid Reza Alipour, Assistant Professor, Islamic Azad University, Rasht Branch, Iran. Olive Exports and Its Difficulties: A Case Study of (Iran) Guilan. (Marketing)
4. Abdelsalam Alkizza, Lecturer, University of Benghazi, Libya. Cost Accounting Practices in Libya. (Tuesday 2 July 2013)
5. Suliman Alsadan, Faculty Staff Member, Institute of Public Administration, Saudi Arabia. (Accounting)
6. Taher Amini Golestani, Ph.D. Student, International Institute for Islamic Studies, Iran & Mohammad Sadegh Amin Din, Ph.D. Student, International Institute for Islamic Studies, Iran. Islamic Perspective on Capitalism.
7. Emrah Aydemir, PhD Student, Istanbul University, Turkey and Research Assistant, Firat University, Turkey. Hospital Managers' Sense of Corporate Reputation and the Interaction between Corporate Reputation Practices and Organizational Culture: An Example from the Central Anatolian Region of Turkey. (Management)
8. Abdullah Bamahfouz, Invoicing Section Manager, Saudi Telecom, Company, Saudi Arabia.
9. Bassam Baroma, PhD Student, University of RomeTor Vergata, Italy. The Impact of Performance-Related Variables on Forward-Looking Disclosure in the Annual Reports of Non-Financial Egyptian Companies.
10. Ramzi Ben Abdallah, Professor, University of Quebec at Montreal, Canada. Pricing Options Embedded in Bonds under Jump-Diffusion Interest-Rate Models. (Finance)
11. Imen Ben Slimene, PhD Student, EDSG-CERAG, France. The Trade-Off Between Real Activities Manipulation and Accrual –Based Earnings Management in Europe: The Effect of Audit Quality.
12. Sylvie Berthelot, Professor, University of Sherbrooke, Canada & Michel Coulmont, Professor, University of Sherbrooke, Canada. The Global Reporting Initiative (GRI) and its Users: A 10-Year plus Retrospective.
13. Michal Bresky, Researcher, CERGE-EI, Czech Republic. Bidding in the Treasury Auctions and the Effect of the Seller's Strategy.
14. *Hans Bystrom, Professor, Lund University, Sweden. Do Chinese Investors Read News? (Finance)
15. Sonia Capelli, Professor, Clermont University, France. The effects of the Customer Participation in Communication (Marketing)

16. Lu-Jui Chen, Associate Professor, Ming-Chuan University, Taiwan, Feng-Hsu Liu, Assistant Professor, Shih Hsin University, Taiwan, Sheng-Te Chou, Assistant Professor, Chinese Culture University, Taiwan & Hung Tai Tsou, Assistant Professor, Ming Dao University, Taiwan. Knowledge Creation and Importance of Subsidiaries: A Study of the Effectiveness of Local Embeddedness and Headquarters' Attention. (Management)
17. Tailan Chi, Professor, University of Kansas, USA. China's Economic Reform and the Creation and Development of Business Groups: A Comparative Institutional Perspective.
18. Ya-Ling Chiu, Assistant Professor, Tungnan University, Taiwan & Chia-Yuan Jiang, Assistant Professor, Taiwan. Why Customers are Loyal to a Particular Online Discount Voucher: Mediating Effects of Affective Commitment. (Marketing)
19. K-Rine Chong, Assistant Lecturer, University Tun Abdul Razak, Malaysia, Ben Chin-Fook Yap, Senior Lecturer, University Tun Abdul Razak, Malaysia & Zulkifflee Mohamad, Assistant Professor, Deputy Dean, University Tun Abdul Razak, Malaysia. A Study on the Application of Factor Analysis and the Distributional Properties of Financial Ratios of Malaysian Companies. (Finance)
20. Lal C. Chugh, Professor, University of Massachusetts Boston, USA. Responses and Results to European Crisis.
21. Michel Coulmont, Professor, University of Sherbrooke, Canada, Sylvie Berthelot, Professor, University of Sherbrooke, Canada & Marjolaine Lapierre, Supervisor, PricewaterhouseCoopers LLP, Canada. The Corporate Social Responsibility Reporting of Canadian Banks and the Neo-Institutional Theory.
22. *Adina Dudau, Lecturer, University of Glasgow, UK. Revisiting Leadership in Public Partnerships: The Case of Local Safeguarding Children Boards. (Management)
23. Christine Edwards, Lecturer, Course Coordinator & Tutor, Eynesbury Institute of Business and Technology & University of South Australia, Australia & Ronald Donato, Professor, University of South Australia, Australia. Marketing Concept Comprehension and Recall through Imagery – The Case of International Students.
24. El Mehdi Ferrouhi, PhD Student, Mohammed 5 University, Morocco & Abderrassoul Lehadiri, Professor, Mohammed 5 University, Morocco. Financial Crisis, Banks' Size and Determinants of Moroccan Banks' Liquidity.
25. *Alessandro Ghio, PhD Student, University of Pisa, Italy. Accounting Gaps: Empirical Evidence from a Case Study.
26. *Nicholas Grigoriou, Lecturer, Monash University, Malaysia. Level of Consumer Involvement and New Product Development: The Moderating Role of Product Type. (Marketing)
27. Saleh Hasanloo, University of Tehran, Iran. Sensitivity Analysis & Evaluating Performance of Companies. (Management)
28. Tareq Hashem, Associate Professor, Philadelphia University, Jordan. Motives and Determinants of Using Jordan as a Destination from Tourists' Perspectives. (Marketing)
29. Besma Hkiri, Assistant Professor, University of Sousse, Tunisia. Sector Price Co-Movements and Portfolio Risk Assessment in the Saudi Market: A Wavelet Coherency Analysis. (Finance)
30. Rani Hoitash, Associate Professor, Bentley University, USA, Olubunmi Faleye, Associate Professor, Northeastern University, USA & Udi Hoitash, Assistant Professor, Northeastern University, USA. Industry Expertise on Corporate Boards. (Finance)
31. Daire Hooper, Lecturer, Dublin Institute of Technology, Ireland. Exploring the Impact of Culture on Customer Satisfaction Metrics. (Marketing)
32. Sun A Kang, Assistant Professor, Chungnam National University, South Korea. An Empirical Study on Value Relevance of K-IFRS Adoption. (Accounting) (Tuesday 2nd of July 2013, morning session)
33. Monique Keevy, Lecturer, University of Johannesburg, South Africa. An Analysis of Accounting Academic's Awareness of, and Ability to Deliver, Pervasive Qualities and Skills.
34. Reabetswe Kgoroeadira, PhD Student, Cranfield University, UK. New Technology, Same Old Story? Factors Driving Credit Allocation for Small Business Loans on Commercial Peer-to-Peer Lending Websites. (Finance)
35. Esamaddin Khorwatt, Head of Postgraduate Department, University of AlJabal, Libya. Libyan Auditors' Perceptions of Business Risk.
36. Tunyarputt Kiaterittinun, Lecturer, Swinburne University of Technology, Australia. An Empirical Examination of Price-Effect Differentials between Family and Non-Family Listed Firms. (Finance)

37. Suzanne Kievet, Lecturer, Univeristy of Stellenbosch, South Africa. Contradictory Laws in the Quest to Alleviate Unemployment. (Accounting)
38. Youngchan Kim, Professor, Yonsei University, South Korea, Byunghwa Yang, Professor, Kangwon University, South Korea & Min Jeong Ko, Ph.D Student, Yonsei University, South Korea. Dual Routes to Customer Loyalty: A Comparison and Integration of an Exchange-based vs. a Relational-based Approach. (Marketing)
39. Georgios Kominis, Lecturer, University of Glasgow, UK, Adina Dudau, Lecturer, University of Glasgow, UK & Alvise Favotto, University of Glasgow, UK. A Multifaceted Approach to the Construct of Rewards Lessons from the Private Sector. (Accounting)
40. Gregory Koutmos, Professor, Fairfield University, USA. Hedge Funds: Market Timing and the Dynamics of Systematic Risk. (Finance)
41. Peter Koveos, Professor and Director, Syracusee University, USA. (Finance)
42. Mihalis Kuyucu, Assistant Professor, Istanbul Aydin University and GBTimes Turkey Media / G.M., Turkey. Marketing of Radio Stations: A Research about How Radio Stations Market Themselves in Turkey. (Marketing) (Tuesday 2nd of July, afternoon)
43. Tommi Laukkanen, Professor, University of Eastern, Finland. The Role of National Culture and Human Values in Consumer Adoption Behavior.
44. Ede Lazar, Associate Professor, Sapientia – Hungarian University of Transylvania, Romania. A Price Test Using Binomial Logistic Regression Model. (Marketing)
45. Rongrong Li, Student, Beijing Institute of Technology, China, Xuefeng Wang, Professor, Beijing Institute of Technology, China, Donghua Zhu, Professor, Beijing Institute of Technology, China & Xingrong Xu, Student, Beijing Institute of Technology, China. Measuring and Assessing the Development of Nanotechnology Based on Bibliometric Analysis. (Management) (Monday 1 July 2013)
46. Robert C. Lieb, Professor of Supply Chain Management, Northeastern University, USA. The Evolution and Status of the Global Third Party Logistics Industry. (Management) (Monday 1 July 2013)
47. Jingrong Lin, Assistant Professor, University of Massachusetts at Lowell, USA, Chen Chen, Assistant Professor, University of Auckland, New Zeeland & Yi Hu, Research Fellow, Chinese Academy of Science, China. Accounting Conservatism and Corporate Investment Decisions: Evidence from a Structural Assessment. (Finance)
48. Fen-May Liou, Professor, Chihlee Institute of Technology, Taiwan. Valuation Model of Project Portfolio under Uncertainty. (Finance)
49. Hung-Chun Liu, Associate Professor, Minghsin University of Science & Technology, Taiwan & Jui-Cheng Hung, Associate Professor, Chinese Culture University, Taiwan. The Economic Value of Information Frequencies and Conditional Correlation Specifications on Dynamic Futures Hedge. (Finance)
50. James Mallett, Professor, Stetson University, USA. Disruptive Technology and Financial Market Volatility. (Finance)
51. *Nicholas Mangos, Senior Lecturer, Flinders University Adelaide, Australia & Fernando Pineda Izquierdo, Masters Student, Flinders University Adelaide, Australia. Sustainability Performance Practices in the Cruise Tourism Industry: P&O Australia Compared to Attica Group Greece. (Management) (Monday 1 July 2013)
52. *Vivienne Mangos, Senior Lecturer, TAFE Institute, Australia. Australian Teacher Aides – Addressing the Educational Management Issues of a Marginalised Workforce. (Management) (Monday 1 July 2013)
53. Emeline Martin, Ph.D. Student, Clermont University, France & Sonia Capelli, Director, Clermont University, France. A Brand for a Region: Legitimate Strategy or Marketing Felony? – The Case of France and the Auvergne Region.
54. Omar Meharzi, PhD Candidate, CERAG-UPMF, France. Herding Behavior in the French Stock Market: A Sectoral Empirical Analysis.(Finance)
55. Sridhar Moorthy, Professor, University of Toronto, Canada & Yongmin Chen, Professor, University of Toronto, Canada. Channel Strategy When Consumers Comparison Shop.
56. David Morelli, Lecturer, University of Kent, UK. Momentum Profits and Conditional Time-Varying Systematic Risk.
57. Nicholas Mroczkowski, Lecturer, Australian Catholic University, Australia. An Empirical Examination of Price-Effect Differentials between Family a Non-Family Firms. (Finance)
58. *Tshedi (MN) Naong, HOD: Department of Business Management, Central University of Technology, South Africa. The Impact of Skills-development Training on Employee Motivation and Job Satisfaction in Selected Companies in South Africa. (Management)

59. Thi Tuyet Mai Nguyen, Deputy Editor-in-Chief, Journal of Economics and Development, National Economics University, Vietnam & Vu Hung, National Economics University, Vietnam. An Investigation into Antecedents and Consequences of Urban Vietnamese Consumers' Impulse Buying Behaviour.
60. A.J. Otjen, Professor, Montana State University, Billings, USA & Sarah Keller, Montana State University, Billings, USA. Marketing the Reasons for a City Library in the Face of Negative Attitudes. (Marketing)
61. Dimitra Papadovasilaki, PhD Candidate, University Nevada Reno, USA, Federico Guerrero, Amanda Safford, James Sundali and Gregory R. Stone. Booms, Crashes and Early Investment Experience in a Laboratory Experiment. (Finance)
62. Kaja Prystupa-Rzadca, Researcher, Kozminski University, Poland & Dominica Latusek-Jurczak, Professor, Kozminski University, Poland. Collaboration and Trust-Building in Virtual Open Innovation Community. (Management)
63. Lidija Romic, Full Professor, Serbia. Accounting Policies, Accounting Estimates and Errors.
64. George Rossolatos, PhD Student, University of Kassel, Germany. On the Textual Economy of Brand Equity: Accounting Semiotically for the Difference between Axiology and Linguistic Value.
65. Nedal Sawan, Professor, Liverpool Business School, UK. Perceptions of Auditing and the Provision of Non-Audit Services: Case Study in Libya. (Accounting)
66. Hani Shaiti, Lecturer, University of Bedfordshire, UK, Yanqing Duan, Professor, University of Bedfordshire, UK & Magdy Abdel-kader, Professor, Anglia Ruskin University, UK. Investigating the Relationship between Enterprise Resource Planning (ERP) System and Internal Control: Exploratory Study. (Accounting)
67. *Subramanian Sivaramakrishnan, Associate Professor, University of Manitoba, Canada & Eui-Kyun Lee, Graduate Student, University Of Manitoba, Canada. Effects of Environmental Identity and Perceived Responsibility for Environmental Degradation on Consumers' Feeling of Collective Guilt. (Marketing) (Tuesday 2 July 2013)
68. Anna-Retha Smit, Lecturer, University of Stellenbosch, South Africa. The Effect of Board Composition on the Quality of Reported Earnings. (Tuesday 2 July 2013)
69. Henry Tam, Associate Professor, York University, Canada & Liona Lai, Associate Professor, York University, Canada. Corporate Governance, Ownership Structure and Managing Earnings to Meet Critical Thresholds among Chinese Listed Firms. (Accounting)
70. Khaoula Thabet Ferchichi, Doctorant, University of Auvergne – CRCGM, France & Mohamed Arouri, Professor, University of Auvergne – CRCGM, France. Enterprise Risk Management and Firm Value: A Meta-analysis. (Finance)
71. *Desmond Tsang, Associate Professor, McGill University, Canada. Go Before the Whistle Blows: An Empirical Analysis of Director Turnover and Financial Fraud.
72. *Peter Theuri, Professor, Northern Kentucky University, USA & Amy Messen, Professor, Northern Kentucky University, USA. Minnesota Casting Corporation: A Revenue Recognition Case Study. (Accounting)
73. Nektarios Tzempelikos, Senior Lecturer, Anglia Ruskin University, UK. Assessing Customer Value in Key Account Management Relationships.
74. Patrick Vyncke, Professor, Ghent University, Belgium. The Two Minds of the Consumer. New Insights into Peripheral Advertising Processing and the Concept of Persuasion Cues.
75. Lulu Wang, PhD Student and Researcher, Goethe University Frankfurt, Germany. Conditional Effects of Covenants on Loan Pricing.(Finance)
76. Jying-Nan Wang, Assistant Professor, Michigan University of Science and Technology, Taiwan & Yuan-Teng Hsu, Ph.D. Student, Yuan Ze University, Taiwan. New Perspective on Portfolio Risk: Properties and Applications of the CoPVaR. (Finance)
77. *Sonia Wasan, Assistant Professor, Northern Kentucky University, USA & Bob Russ, Northern Kentucky University, USA. Online Versus Manual Home Assignments in Financial Accounting. (Accounting)
78. *Holger Wendt, PhD Student, Coventry University, UK, Richard Anderson, MBA Program Manager, Senior Lecturer, Coventry University, UK & Katja Kuhn, Academic Dean, Management and Engineering, SRH University Heidelberg, Germany. Conceptualising the Corporate Cultural Fit – A Global Account Management Perspective. (Marketing)

79. Fan Yang, Student, Beijing Institute of Technology, China, Xuefeng Wang, Professor, Beijing Institute of Technology, China, Donghua Zhu, Professor, Beijing Institute of Technology, China & Rongrong Li, Student, Beijing Institute of Technology, China. Analysis on the Trends of R&D in the BRIC Countries' Nanomaterials Based on the Patents Data. (Management) (Monday 1 July 2013)
80. Selcan Yesilyurt, Instructor, Bahcesehir University, Turkey & Idil K Suher, Associate Professor, Bahcesehir University, Turkey. Relationship Management Function of Corporate Communication: Long-Term Relationship or Short-Term Impact. (Management)
81. Rami Yosef, Professor, Ben-Gurion University of the Negev, Israel. Floor Options on Structured Products and Life Insurance Contracts. (Finance)

Organization and Scientific Committee

1. Dr. Gregory T. Papanikos, President, ATINER.
2. Dr. George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.
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6. Dr. Sharon Bolton, Head, Management Research Unit, ATINER & Professor & Head, School of Management, University of Stirling, U.K.
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16. Mr. Vasilis Charalampopoulos, Researcher, ATINER & Ph.D. Student, University of Stirling, U.K.

Administration

Fani Balaska, Stavroula Kiritsi, Eirini Lentzou, Konstantinos Manolidis, Katerina Maraki & Celia Sakka

(The time for each session includes at least 10 minutes coffee break)

Monday 1 July 2013

08:00-09:00 Registration

09:00-09:30 Welcome and Opening Remarks

- Dr. Gregory T. Papanikos, President, ATINER.
- George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.

09:30-11:00 Session I (Room A): Accounting and Finance I: Earnings and Financial Performance **Chair:** Dr. Peter Koveos, Head, Accounting and Finance Research Unit, ATINER & Professor of Finance, Syracuse University, USA.	**09:30-11:00 Session II (Room B): Management I: Knowledge, Innovation, R&D, Technology, Logistics** **Chair:** Dr. Sharon Bolton, Head, Management Research Unit, ATINER & Professor & Head, School of Management, University of Stirling, U.K.	**09:30-11:00 Session III (Room C): Marketing I: Consumer Behaviour** **Chair:** Dr. Cleopatra Veloutsou, Head, Marketing Research Unit, ATINER & Senior Lecturer of Marketing, University of Glasgow, U.K.
82. *Peter Theuri, Professor, Northern Kentucky University, USA & Amy Messen, Professor, Northern Kentucky University, USA. Minnesota Casting Corporation: A Revenue Recognition Case Study. (Accounting) 83. Henry Tam, Associate Professor, York University, Canada & Liona Lai, Associate Professor, York University, Canada. Corporate Governance, Ownership Structure and Managing Earnings to Meet Critical Thresholds among Chinese Listed Firms. (Accounting) 84. *Sonia Wasan, Assistant Professor, Northern Kentucky University, USA & Bob Russ, Northern Kentucky University, USA. Online Versus Manual Home Assignments in Financial Accounting. (Accounting) 85. Bassam Baroma, PhD Student, University of RomeTor Vergata, Italy. The Impact of Performance-Related Variables on Forward-Looking Disclosure in the Annual Reports of Non-Financial Egyptian Companies.	1. Robert C. Lieb, Professor of Supply Chain Management, Northeastern University, USA. The Evolution and Status of the Global Third Party Logistics Industry. (Management) (Monday 1 July 2013). 2. Lu-Jui Chen, Associate Professor, Ming-Chuan University, Taiwan, Feng-Hsu Liu, Assistant Professor, Shih Hsin University, Taiwan, Sheng-Te Chou, Assistant Professor, Chinese Culture University, Taiwan & Hung Tai Tsou, Assistant Professor, Ming Dao University, Taiwan. Knowledge Creation and Importance of Subsidiaries: A Study of the Effectiveness of Local Embeddedness and Headquarters' Attention. (Management) 3. Kaja Prystupa-Rzadca, Research and Teaching Assistant, Kozminski University, Poland & Dominika Latusek-Jurczak, Kozminski University, Poland. Collaboration and Trust-building in Virtual Open Innovation Community 4. Fan Yang, Student, Beijing Institute of Technology, China, Xuefeng Wang, Professor, Beijing Institute of Technology, China, Donghua Zhu, Professor, Beijing Institute of Technology, China & Rongrong Li, Student, Beijing Institute of Technology, China. Analysis on the Trends of R&D in the BRIC Countries' Nanomaterials Based on the Patents Data. (Management) (Monday 1 July 2013)	1. Youngchan Kim, Professor, Yonsei University, South Korea, Byunghwa Yang, Professor, Kangwon University, South Korea & Min Jeong Ko, Ph.D Student, Yonsei University, South Korea. Dual Routes to Customer Loyalty: A Comparison and Integration of an Exchange-based vs. a Relational-based Approach. (Marketing) 2. Thi Tuyet Mai Nguyen, Deputy Editor-in-Chief, Journal of Economics and Development, National Economics University, Vietnam & Vu Hung, National Economics University, Vietnam. An Investigation into Antecedents and Consequences of Urban Vietnamese Consumers' Impulse Buying Behaviour. 3. Tareq Hashem, Associate Professor, Philadelphia University, Jordan. Motives and Determinants of Using Jordan as a Destination from Tourists' Perspectives. (Marketing) 4. Nektarios Tzempelikos, Senior Lecturer, Anglia Ruskin University, UK. Assessing Customer Value in Key Account Management Relationships.

11:00-12:30 Session IV (Room A): Accounting and Finance II: Investment and Dividends Chair:	11:00-12:30 Session V (Room B): Management II: CSR, Leadership, Measurement and Evaluation Chair:	11:00-12:30 Session VI (Room C): Marketing II: Product and Brand Management Chair:
1. Jingrong Lin, Assistant Professor, University of Massachusetts at Lowell, USA, Chen Chen, Assistant Professor, University of Auckland, New Zeeland & Yi Hu, Research Fellow, Chinese Academy of Science, China. Accounting Conservatism and Corporate Investment Decisions: Evidence from a Structural Assessment. (Finance) 2. Tunyarputt Kiaterittinun, Lecturer, Swinburne University of Technology, Australia. An Empirical Examination of Price-Effect Differentials between Family and Non-Family Listed Firms. (Finance) 3. Lulu Wang, PhD Student and Researcher, Goethe University Frankfurt, Germany. Conditional Effects of Covenants on Loan Pricing. (Finance) 4. Ijaz Ali, PhD Student, CERAG Research Laboratory, University of Grenoble, France. Appearance and Disappearance of Dividends: Evidence from Europe. (Finance)	1. Burcu Eker Akgoz, Lecturer, Bahcesehir University, Turkey & Elif Engin, Instructor, Bahcesehir University, Turkey. The History of Corporate Social Responsibility in Turkey: Analysis of Koç Holding and Sabancı Holding's Social Responsibility Practices. (Management) (Monday 1 July 2013) 2. *Nicholas Mangos, Senior Lecturer, Flinders University Adelaide, Australia & Fernando Pineda Izquierdo, Masters Student, Flinders University Adelaide, Australia. Sustainability Performance Practices in the Cruise Tourism Industry: P&O Australia Compared to Attica Group Greece. (Management) (Monday 1 July 2013) 3. *Vivienne Mangos, Senior Lecturer, TAFE Institute, Australia. Australian Teacher Aides – Addressing the Educational Management Issues of a Marginalised Workforce. (Management) (Monday 1 July 2013) 4. Rongrong Li, Student, Beijing Institute of Technology, China, Xuefeng Wang, Professor, Beijing Institute of Technology, China, Donghua Zhu, Professor, Beijing Institute of Technology, China & Xingrong Xu, Student, Beijing Institute of Technology, China. Measuring and Assessing the Development of Nanotechnology Based on Bibliometric Analysis. (Management) (Monday 1 July 2013)	1. Ede Lazar, Associate Professor, Sapientia – Hungarian University of Transylvania, Romania. A Price Test Using Binomial Logistic Regression Model. (Marketing) 2. *Nicholas Grigoriou, Lecturer, Monash University, Malaysia. Level of Consumer Involvement and New Product Development: The Moderating Role of Product Type. (Marketing) 3. George Rossolatos, PhD Student, University of Kassel, Germany. On the Textual Economy of Brand Equity: Accounting Semiotically for the Difference between Axiology and Linguistic Value. 4. Emeline Martin, Ph.D. Student, Clermont University, France & Sonia Capelli, Director, Clermont University, France. A Brand for a Region: Legitimate Strategy or Marketing Felony? – The Case of France and the Auvergne Region.

13:30-14:30 Lunch

14:30-16:00 Session VII (Room A): Accounting and Finance III: Derivatives and Hedge Funds Chair:	14:30-16:00 Session VIII (Room B): Marketing III: International Marketing Chair:
1. Ramzi Ben Abdallah, Professor, University of Quebec at Montreal, Canada. Pricing Options Embedded in Bonds under Jump-Diffusion Interest-Rate Models. (Finance) 2. Gregory Koutmos, Professor, Fairfield University, USA. Hedge Funds: Market Timing and the Dynamics of Systematic Risk. (Finance) 3. Hung-Chun Liu, Associate Professor, Minghsin University of Science & Technology, Taiwan & Jui-Cheng Hung, Associate Professor, Chinese Culture University, Taiwan. The Economic Value of Information Frequencies and Conditional Correlation Specifications on Dynamic Futures Hedge. (Finance). 4. Rami Yosef, Professor, Ben-Gurion University of the Negev, Israel. Floor Options	1. Christine Edwards, Lecturer, Course Coordinator & Tutor, Eynesbury Institute of Business and Technology & University of South Australia, Australia & Ronald Donato, Professor, University of South Australia, Australia. Marketing Concept Comprehension and Recall through Imagery – The Case of International Students. 2. Daire Hooper, Lecturer, Dublin Institute of Technology, Ireland. Exploring the Impact of Culture on Customer Satisfaction Metrics. (Marketing) 3. Dr Hamid Reza Alipour, Assistant Professor, Islamic Azad University, Rasht Branch, Iran. Olive Exports and Its Difficulties: A Case Study of (Iran) Guilan. (Marketing)

on Structured Products and Life Insurance Contracts. (Finance)	

16:00-17:30 Session IX (Room A): Accounting and Finance IV: Country Studies
Chair:

1. John Kallianiotis, Professor, University of Scranton, USA. The U.S. Dollar as an International Reserve and its Undervaluation.
2. *Hans Bystrom, Professor, Lund University, Sweden. Do Chinese Investors Read News? (Finance)
3. Peter Koveos, Professor and Director, Syracusee University, USA and Yimin Zhang, China's Financial Markets: Why Aren't they Open?
4. Suzanne Kievet, Lecturer, Univeristy of Stellenbosch, South Africa. Contradictory Laws in the Quest to Alleviate Unemployment. (Accounting)
5. Taher Amini Golestani, Ph.D. Student, International Institute for Islamic Studies, Iran & Mohammad Sadegh Amin Din, Ph.D. Student, International Institute for Islamic Studies, Iran. Islamic Perspective on Capitalism.

17:30-19:30 Session X (Room A): Accounting and Finance V: Studies in Financing and Financial Performance
Chair:

1. Fen-May Liou, Professor, Chihlee Institute of Technology, Taiwan. Valuation Model of Project Portfolio under Uncertainty. (Finance)
2. K-Rine Chong, Assistant Lecturer, University Tun Abdul Razak, Malaysia, Ben Chin-Fook Yap, Senior Lecturer, University Tun Abdul Razak, Malaysia & Zulkifflee Mohamad, Assistant Professor, Deputy Dean, University Tun Abdul Razak, Malaysia. A Study on the Application of Factor Analysis and the Distributional Properties of Financial Ratios of Malaysian Companies. (Finance)
3. Khaoula Thabet Ferchichi, Doctorant, University of Auvergne – CRCGM, France & Mohamed Arouri, Professor, University of Auvergne – CRCGM, France. Enterprise Risk Management and Firm Value: A Meta-analysis. (Finance)
4. Jying-Nan Wang, Assistant Professor, Michigan University of Science and Technology, Taiwan & Yuan-Teng Hsu, Ph.D. Student, Yuan Ze University, Taiwan. New Perspective on Portfolio Risk: Properties and Applications of the CoPVaR. (Finance)
5. El Mehdi Ferrouhi, PhD Student, Mohammed 5 University, Morocco & Abderrassoul Lehadiri, Professor, Mohammed 5 University, Morocco. Financial Crisis, Banks' Size and Determinants of Moroccan Banks' Liquidity.
6. Reabetswe Kgoroeadira, PhD Student, Cranfield University, UK. New Technology, Same Old Story? Factors Driving Credit Allocation for Small Business Loans on Commercial Peer-to-Peer Lending Websites. (Finance)
7. Farai Kwenda, PhD Candidate, University of KwaZulu Natal, South Africa & Merle Holden, Professor, University of KwaZulu Natal, South Africa. Investment and Financing Constraints: Is Working Capital Management Making a Difference in South Africa? (Finance)

21:00-23:00 Greek Night and Dinner (Details during registration)

Tuesday 2 July 2013

08:30-10:30 Session XI (Room A): Accounting and Finance VI: Auditing and Standards
Chair:

1. Sun A Kang, Assistant Professor, Chungnam National University, South Korea. An Empirical Study on Value Relevance of K-IFRS Adoption. (Accounting) (Tuesday 2nd of July 2013, morning session)
2. *Alessandro Ghio, PhD Student, University of Pisa, Italy. Accounting Gaps: Empirical Evidence from a Case Study.
3. Esamaddin Khorwatt, Head of Postgraduate Department, University of AlJabal, Libya. Libyan Auditors' Perceptions of Business Risk.
4. Nedal Sawan, Professor, Liverpool Business School, UK. Perceptions of Auditing and the Provision of Non-Audit Services: Case Study in Libya. (Accounting)
5. Hani Shaiti, Lecturer, University of Bedfordshire, UK, Yanqing Duan, Professor, University of Bedfordshire, UK & Magdy Abdel-kader, Professor, Anglia Ruskin University, UK. Investigating the Relationship between Enterprise Resource Planning (ERP) System and Internal Control: Exploratory Study. (Accounting)

10:30-12:00 Session XII (Room A): Accounting and Finance VII: Accounting Practices
Chair:

1. Abdelsalam Alkizza, Lecturer, University of Benghazi, Libya. Cost Accounting Practices in Libya. (Tuesday 2 July 2013)
2. Steven De Klerck, Researcher, Antwerp University, Belgium & Jan Annaert, Professor, Antwerp University, Belgium & Marc De Ceuster, Professor, Antwerp University, Belgium. Under Siege: The Current Paradigm in the Field of Financial Statement Analysis.
3. Monique Keevy, Lecturer, University of Johannesburg, South Africa. An Analysis of Accounting Academic's Awareness of, and Ability to Deliver, Pervasive Qualities and Skills.
4. Georgios Kominis, Lecturer, University of Glasgow, UK, Adina Dudau, Lecturer, University of Glasgow, UK & Alvise Favotto, University of Glasgow, UK. A Multifaceted Approach to the Construct of Rewards Lessons from the Private Sector. (Accounting)
5. Lidija Romic, Full Professor, Serbia. Accounting Policies, Accounting Estimates and Errors.

10:30-12:00 Session XIII (Room B): Management III: Performance, & Managerial Practice
Chair:

1. *Adina Dudau, Lecturer, University of Glasgow, UK. Revisiting Leadership in Public Partnerships: The Case of Local Safeguarding Children Boards. (Management)
2. Saleh Hasanloo, University of Tehran, Iran. Sensitivity Analysis & Evaluating Performance of Companies. (Management)
3. Emrah Aydemir, PhD Student, Istanbul University, Turkey and Research Assistant, Firat University, Turkey. Hospital Managers' Sense of Corporate Reputation and the Interaction between Corporate Reputation Practices and Organizational Culture: An Example from the Central Anatolian Region of Turkey. (Management)

10:30-12:00 Session XIV (Room C): Marketing IV: Managing the Marketing Efforts: Account Management and Marketing Tactics
Chair:

1. Sridhar Moorthy, Professor, University of Toronto, Canada & Yongmin Chen, Professor, University of Toronto, Canada. Channel Strategy When Consumers Comparison Shop.
2. A.J. Otjen, Professor, Montana State University, Billings, USA & Sarah Keller, Montana State University, Billings, USA. Marketing the Reasons for a City Library in the Face of Negative Attitudes. (Marketing)
3. *Subramanian Sivaramakrishnan, Associate Professor, University of Manitoba, Canada & Eui-Kyun Lee, Graduate Student, University Of Manitoba, Canada. Effects of Environmental Identity and Perceived Responsibility for Environmental Degradation on Consumers' Feeling of Collective Guilt. (Marketing) (Tuesday 2 July 2013)
4. Holger Wendt, PhD Student, Coventry University, UK, Richard Anderson, MBA Program Manager, Senior Lecturer, Coventry University, UK & Katja Kuhn, Academic Dean, Management and Engineering, SRH University Heidelberg, Germany. Conceptualising the Corporate Cultural Fit – A Global Account Management Perspective. (Marketing)

12:00-13:00 Lunch

13:00-14:30 Session XV (Room A): Accounting and Finance VIII: Corporate Governance Chair:	13:00-14:30 Session XVI (Room B): Management IV: Chair:	13:00-14:30 Session XVII (Room C): Marketing V: Marketing Communications Chair:
1. Sylvie Berthelot, Professor, University of Sherbrooke, Canada & Michel Coulmont, Professor, University of Sherbrooke, Canada. The Global Reporting Initiative (GRI) and its Users: A 10-Year plus Retrospective. 2. Michel Coulmont, Professor, University of Sherbrooke, Canada, Sylvie Berthelot, Professor, University of Sherbrooke, Canada & Marjolaine Lapierre, Supervisor, PricewaterhouseCoopers LLP, Canada. The Corporate Social Responsibility Reporting of Canadian Banks and the Neo-Institutional Theory. 3. Anna-Retha Smit, Lecturer, University of Stellenbosch, South Africa. The Effect of Board Composition on the Quality of Reported Earnings. (Tuesday 2 July 2013) 4. *Desmond Tsang, Associate Professor, McGill University, Canada. Go Before the Whistle Blows: An Empirical Analysis of Director Turnover and Financial Fraud. 5. Rani Hoitash, Associate Professor, Bentley University, USA, Olubunmi Faleye, Associate Professor, Northeastern University, USA & Udi Hoitash, Assistant Professor, Northeastern University, USA. Industry Expertise on Corporate Boards	1. Selcan Yesilyurt, Instructor, Bahcesehir University, Turkey & Idil K Suher, Associate Professor, Bahcesehir University, Turkey. Relationship Management Function of Corporate Communication: Long-Term Relationship or Short-Term Impact. (Management) 2. Tailan Chi, Professor, University of Kansas, USA. China's Economic Reform and the Creation and Development of Business Groups: A Comparative Institutional Perspective. 3. *Tshedi (MN) Naong, HOD: Department of Business Management, Central University of Technology, South Africa. The Impact of Skills-development Training on Employee Motivation and Job Satisfaction in Selected Companies in South Africa. (Management)	1. Sonia Capelli, Professor, Clermont University, France. The effects of the Customer Participation in Communication (Marketing) 2. Mihalis Kuyucu, Assistant Professor, Istanbul Aydin University and GBTimes Turkey Media / G.M., Turkey. Marketing of Radio Stations: A Research about How Radio Stations Market Themselves in Turkey. (Marketing) (Tuesday 2nd of July, afternoon) 3. Patrick Vyncke, Professor, Ghent University, Belgium. The Two Minds of the Consumer. New Insights into Peripheral Advertising Processing and the Concept of Persuasion Cues. 4. Ya-Ling Chiu, Assistant Professor, Tungnan University, Taiwan & Chia-Yuan Jiang, Assistant Professor, Taiwan. Why Customers are Loyal to a Particular Online Discount Voucher: Mediating Effects of Affective Commitment. (Marketing)

14:30-16:00 Session XVIII (Room A): Accounting and Finance IX: Market Movements and Co-Movements Chair:
1. Besma Hkiri, Assistant Professor, University of Sousse, Tunisia. Sector Price Co-Movements and Portfolio Risk Assessment in the Saudi Market: A Wavelet Coherency Analysis. (Finance) 2. James Mallett, Professor, Stetson University, USA. Disruptive Technology and Financial Market Volatility. (Finance) 3. Omar Meharzi, PhD Candidate, CERAG-UPMF, France. Herding Behavior in the French Stock Market: A Sectoral Empirical Analysis.(Finance) 4. Dimitra Papadovasilaki, PhD Candidate, University Nevada Reno, USA, Federico Guerrero, Amanda Safford, James Sundali and Gregory R. Stone. Booms, Crashes and Early Investment Experience in a Laboratory Experiment. (Finance) 5. Jying-Nan Wang, Assistant Professor, Michigan University of Science and Technology, Taiwan & Yuan-Teng Hsu, Ph.D. Student, Yuan Ze University, Taiwan. New Perspective on Portfolio Risk: Properties and Applications of the CoPVaR. (Finance)

17:30-20:30 Urban Walk (Details during registration)

21:00- 22:00 Dinner (Details during registration)

Wednesday 3 July 2013

Cruise: (Details during registration)

Thursday 4 July 2013

Delphi Visit: (Details during registration)

Valuation Model of Project Portfolio under Uncertainty

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Chihlee Institute of Technology
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Borliang Chen
Associate Professor
National United University
Department of Civil Engineering & Disaster Prevention
Taiwan

Abstract

This paper develops a valuation model for evaluating a project portfolio that consists of more than one project scheme as well as cash-flow streams. Unlike the traditional DCF model, which assesses project risk based on a single cash-flow bundle, that is, a combined stream of all the cash flows of the project schemes, the project portfolio valuation model investigates the individual project risk of each scheme to evaluate the managerial flexibility under uncertainty. In this paper, we show that the cash flow bundle may over- or under-estimate the managerial flexibility and suggest a project portfolio approach for an investment program with multiple projects under uncertainty. The Black and Scholes valuation model is used to verify the propositions described above. A case with simulation data is used to illustrate the approach and the findings support our arguments. This research contributes to the methodology of capital budgeting in corporate finance.

Keywords: Capital Budgeting, Discounted Cash Flow Method, Real Options

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1. Introduction

When a company is considering an investment program that consists of more than one correlated project, it usually integrates the revenues and costs of all the schemes into one combined cash flow (a cash-flow bundle) to test the feasibility, which is a traditional discounted cash flow method. In the risk analysis section, it changes the assumptions for the parameters of each scheme in the base case to test the robustness of this project portfolio. The risk of the program can be measured by the variance of this cash-flow bundle. If the company further evaluates the managerial flexibility of the project portfolio under uncertainty, it adds the values of management decisions to the project worth. Since the combined cash flow ties all project schemes into one bundle, the managerial flexibility under uncertainty is therefore evaluated based on this single cash flow bundle. This project analysis procedure implies that the risks of the schemes are inseparable. In this paper, we first show that the cash flow bundle of a project portfolio may over- or under-estimate the value of managerial flexibility and then propose a revised valuation model of project portfolio under uncertainty. This research contributes to the methodology of capital budgeting in corporate finance.

The discounted cash flow (DCF) model is the most widely used method in the valuation of projects, firms, or assets that are expected to earn a stream of cash flow over time. The DCF method predicts, under a set of assumptions regarding revenues and costs, the cash flow to be generated by the underlying assets and uses appropriate discount factors to estimate the net present value (NPV) or other decision criteria. This predicted cash flow and the respective decision indicator form the base case of the project valuation.

Subsequently, a sensitivity analysis, scenario analysis, or simulation model is utilized based on the base case to assess the risk of the project assuming that the predictors diverge from their initial assumptions. In particular, the Monte Carlo method simulates the underlying distribution of the NPV and the associated expected value ($E(NPV)$) and standard deviation (σ_{NPV}).

2. Traditional DCF Model for Multiple Projects

For an investment program that consists of more than one project, the DCF method combines all the streams of cash flow into one to estimate the bundled NPV (NPV_{bundle}) as the base case for the subsequent risk analysis. With this approach, the expected NPV (Equation 1) of this combined cash flow ($\overline{\overline{NPV}}_{bundle}$) is the expected value of the *n* possible NPVs ($\sum_{j=1}^{n} E\left(NPV_{boundle,j}\right)$) determined by the *m* cash streams over a time period of T ($\sum_{t=1}^{T}\sum_{i=1}^{m} CF_{it}$).

$$\overline{NPV}_{bundle} = \sum_{j=1}^{n} E(NPV_j) = \sum_{j=1}^{n} \sum_{t=1}^{T} \sum_{i=0}^{m} \frac{CF_{jit}}{(1+r_i)} - I_{it} = V_{bundle} - I_{bundle} \quad (1)$$

As a complement to the traditional DCF method, the real option model adds the value of the managerial flexibility in making decisions and the innovation capability into the underlying project. The manager can choose to defer, expand, or abandon the project in response to unexpected market changes. The value of the flexibility contributes additional value to the NPV of the underlying project. Therefore, the expanded NPV of the project (NPV_{bundle}) is the sum of its passive NPV (V_{bundle}) and an option value (C_{bundle}) (Denison, Farrell & Jackson, 2012; Trigeorgis, 1993).

$$TV_{bundle} = NPV_{bundle} + C_{bundle} \quad (2)$$

The real option pricing model, which applies option valuation techniques to capital budgeting decisions has been used to evaluate the managerial flexibility in corporate and project investment (e.g., Carlson, Fisher & Giammarino, 2006; Grullon, Lyandres & Zhdanov, 2012; Luehrman, 1998; McDonald & Siegel, 1986; ; Trigeorgis, 1993a; 1993b; Yeo & Qiu, 2003). This model has been shown to be empirically practical for financial decisions (Amram & Kulatilaka, 1999; Dixit & Pindyck, 1994; Edleson, 1994; Quigg, 1993). In the Black-Scholes-based valuation model, the expected value of assets is a stochastic variable with the geometric Brownian motion shown in Equation (3). Equation (4) illustrates a real option function based on the Black-Scholes option model used to estimate the value of the managerial flexibility in investment decisions (C_{bundle}).

$$dV_{bundle} = \mu V_{bundle} dt + \sigma_{bundle} V_{bundle} dw \quad (3)$$

$$C_{bundle} = V_{bundle} N(d_1) - I_{bundle} e^{-rT} N(d_2) \quad (4)$$

$$d_1 = \frac{\ln\left(\frac{V_{bundle}}{I}\right) + \left(r + \frac{\sigma_{bundle}^2}{2}\right)\tau}{\sigma_{bundle}\sqrt{\tau}}$$

$$d_2 = \frac{\ln\left(\frac{V_{bundle}}{I}\right) + \left(r - \frac{\sigma_{bundle}^2}{2}\right)\tau}{\sigma_{bundle}\sqrt{\tau}} = d_1 - \sigma_{bundle}\sqrt{\tau}$$

$$\tau = T - t$$

whereas

C_{bundle} = the value of managerial flexibility or decisions

V_{bundle} = expected present value of the cash flow of all project schemes

I_{bundle} = present value of investment outlays; (the cost of converting the investment opportunity into the option's underlying asset)

T = length of deferral time

$T_j - t_j$ = time to expiry in decimals of a year

σ_{bundle} = volatility of the project's return

r = discount rate indicating the time value of money

The variance of the cash flow bundle of the project portfolio is the degree of diversification of all the possible outcomes (NPV_j) from the expected outcome (NPV_{bundle}), that is,

$$\sigma^2_{bundle} = \frac{\sum_{j=1}^{m}\left(NPV_{bundle,j} - E\left(NPV_{bundle}\right)\right)^2}{m} \tag{5}$$

The traditional DCF method directly examines the risk of the investment portfolio based on one cash flow bundle and ignores the covariance among projects. This paper shows how the traditional DCF may under- or over-estimate the risk of an investment portfolio. The real option-pricing model improves the DCF method by adding the value of flexibility and innovation from management to the project (Yeo & Qiu, 2003) and is practically tested and found to be useful (Quigg, 1993). In the next section, we will show that this single-scheme project valuation model may not be appropriate for a project portfolio consisting of more than one scheme in some circumstances.

3. Valuation Model for Project Portfolio Consisting of Two Schemes

Assume a project portfolio with two schemes A and B. The proportions of these two schemes in the total investment of the portfolio are denoted as w_A and w_B, respectively, provided that $w_A + w_B = 1$. The expected NPV of the project portfolio is a weighted average of the expected NPVs of schemes A and B, with w_A and w_B as the weights, as shown in Equation (6).

$$\mathrm{E}(V_P) = w_A E(V_A) + w_B E(V_B) \tag{6}$$

In addition, the variance of the NPV on the two-scheme portfolio is the sum of the variances of schemes A and B, plus the covariance (σ_{AB}) between these

two schemes multiplied by their correlation coefficient (ρ_{AB}), as presented in Equation (7).

$$\sigma_P^2 = (w_A\sigma_A + w_B\sigma_B)^2 = {w_A}^2{\sigma_A}^2 + {w_B}^2{\sigma_B}^2 + 2w_Aw_B\rho_{AB}\sigma_A\sigma_B \quad (7)$$

Let (V_A, I_A) and (V_B, I_B) denote the value and investment cost of the underlying assets to be built by schemes A and B, respectively. All V_i and I_i $(i = A, B)$ follow the geometric Brownian motion, so that

$dV_i = \mu V_i dt + \sigma_i V_i dz_1$ and

$dI_i = \mu I_i dt + \sigma_i I_i dz_2$ i = A, B.

The managerial decision values for the two schemes can be measured individually using the real option model as shown in Equation (8).

$$\begin{cases} C_A = V_A N(d_{11}) - I_A e^{-r\tau} N(d_{12}) \\ C_B = V_B N(d_{21}) - I_B e^{-r\tau} N(d_{22}) \end{cases} \quad (8)$$

As mentioned above, the management decision value for the project portfolio based on the traditional cash flow bundle is measured by the integrated values of the assets $(V_A + V_B)$ and investment cost $(I_A + I_B)$, as shown in Equation (9).

$$C_{bundle} = V_{bundle} N(d_{bundle1}) - I_{bundle} e^{-r\tau} N(d_{bundle2})$$

$$= (V_A + V_B) N(d_{bundle1}) - (I_A + I_B) e^{-r\tau} N(d_{bundle2}) \quad (9)$$

Equations (8) and (9) show that C_{bundle} equals $C_A + C_B$ only if $d_{bundle1} = d_{11} = d_{21}$ and $d_{bundle2} = d_{12} = d_{22}$. Equation (8) signifies that the variance of the two-scheme portfolio may be reduced if these two schemes are negatively correlated and it increases if they are positively correlated. Therefore, the variance, and the value of managerial decisions for the project, based on the bundled cash flow is most likely under- or over-estimated. Similarly, management decision value for the project portfolio (C_p) can be larger, equal, or smaller, than that for the project bundle (C_{bundle}) depending on ρ_{AB} as follows:

$$
\begin{aligned}
&C_p > C_{bundle} \text{ if } \rho_{AB} > 0 \\
&C_p = C_{bundle} = C_A + C_B \text{ if } \rho_{AB} = 0 \\
&C_p < C_{bundle} \text{ if } \rho_{AB} < 0
\end{aligned} \tag{10}
$$

4. Illustration of Portfolio Valuation Model with Simulation Data

This section uses a hotel development program in Taiwan to illustrate the difference between the results generated from the cash-flow bundle valuation approach and the portfolio valuation approach. The numbers in the paper have been adjusted in order to better present the possible diversification of the outcomes from the combined cash flow model and the portfolio model. In this section, the combined cash flow or cash flow bundle refers to cash flow that integrates both the revenues and costs of the two buildings into one cash flow, while the cash flow portfolio or portfolio refers to the two separate cash flows from the operations of the corresponding building.

The program consists of building hotel rooms in an accommodation area, along with restaurants, which can be built independently from the hotel. The potential customers for these restaurants are not limited to hotel guests, but they are open to the public. According to past experiences in Taiwan, the general public is the major sources of revenues for hotel restaurants if they are run well. The simplified pro forma cash flow of the program is listed in the Appendix. To simplify the analysis, we assume that the program has a limited life of 40 years. The estimated initial investment is 650 million New Taiwan Dollars (NT$), of which the cost of the accommodation area and restaurants are NT$430 million and NT$221 million, respectively. The cost of equity is 9%. The correlation coefficient of the return on the assets between the hotel industry and the restaurant industry is close to 0 (0.001), which indicates a low correlation between the performances of these two businesses.

To estimate the risk of the program, we conducted individual Monte Carlo simulations (Wittwer 2004) on the three cash streams: the hotel accommodations, restaurants, and combined case. The input in these simulations were revenue-related items, including accommodation fees (π_1), unit prices of dishes (π_2), and occupation rates (δ) for the hotel rooms (Equation 11).

$$\text{NPV} = f(\pi_1, \pi_2, \delta) \tag{11}$$

whereas all the other factors are given.

We used the Monte Carlo simulation software Crystal Ball to make 10,000 runs for each of the three cash streams. Table 1 shows the results of the simulations. The expected NPVs of the base cases assume that the project can be accepted only when the NPV is positive and should be rejected when the NPV is negative. The simulation outcomes include negative NPVs because the

simulation did not account for managers' choices such as postponing a project when the market was poor. Therefore, the expected NPVs derived from the simulations are lower than those in cases where managers had the flexibility to halt projects if the predicted outcomes were negative. We add the real option price, which indicates the value of the managerial flexibility, into the project worth. Equation (7) estimates the standard deviation of the cash flow portfolio, and Equations (8) and (9) estimate the managerial flexibility values (the real option model) of the three cash streams. In order to illustrate the effect of the correlation coefficient between two cash streams, we study the real option pricing over time at three different levels of correlation between the hotel accommodations and the restaurant businesses and present the results in Figure 1.

Figure 1a shows that the results of the real option valuation on the cash flow portfolio are similar to those for the combined cash flow. Figure 1b indicates that the results of the real option valuation based on the cash flow portfolio are higher than those for the combined cash flow when the correlation coefficient is positive 0.4. In contrast, the value of managerial flexibility based on the combined cash flow is higher than those for the cash flow portfolio when the correlation coefficient is negative 0.4.

4. Conclusions and Recommendations

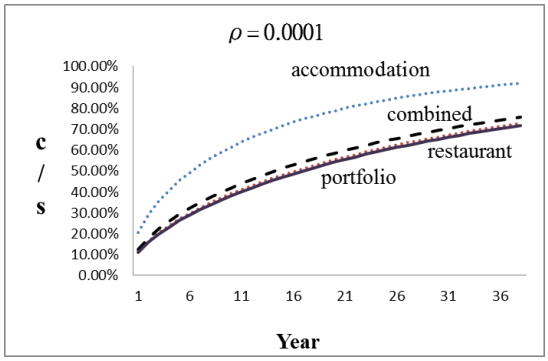
This paper suggested that the traditional DCF method may over- or underestimate the value of managerial flexibility when there is more than one business, and cash stream, in an investment program. This is because the practitioners usually combine the cash streams of various businesses into one cash flow bundle, which does not account for the correlation between the businesses. We call a cash stream that integrates all the cash flow into one bundle a combined cash flow or cash flow bundle. In addition, the cash flow portfolio refers to the separate cash streams being studied. We used the Black and Scholes Model, a model that can be used to evaluate the value of managerial flexibility, to present our arguments and suggested that the value of flexibility derived from the cash flow portfolio is higher than that from the combined cash flow if the correlations between the two cash streams are positive and vice versa. Finally, we use a hotel and restaurant development program to demonstrate our propositions. We used Monte Carlo simulations to predict the expected NPV and the risk (standard deviation of the percentage change in NPV) of each of the cash streams and used them as inputs in the Black and Scholes valuation model. The results supported our arguments.

Table 1. Results of Monte Carlo simulations on base cases

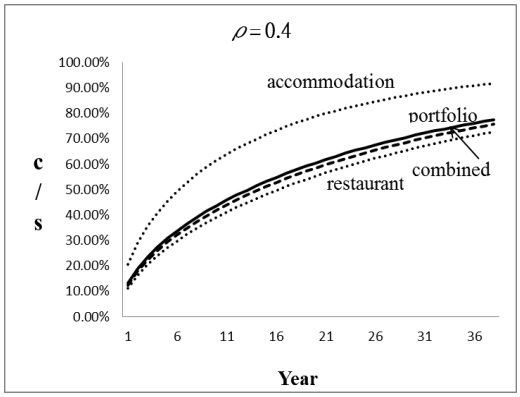
Million New Taiwan Dollars

	Combined case	Hotel accommodation	Restaurants
Expected NPV	526	31	493
Standard deviation (σ)	306	819	269
Minimum NPV	-164	-227	-969
Maximum NPV	3,708	864	2,788
Standard deviation of % change in NPV	0.29	0.5	0.26

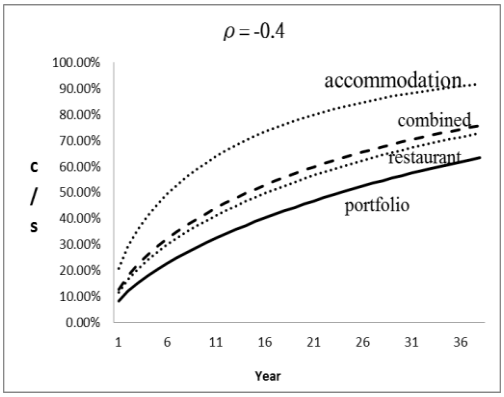
Figure 1. Value of real option with various correlation coefficients



(1a)



(1b)



(1c)

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Appendix. Pro Forma Cash Flow of hotel and restaurant program

Year	1	2	3	4	5	10	15	20	25	30	35	40
Total cash inflow												
Hotel rooms	175	119	41	42	43	47	52	57	63	70	77	85
Restaurants	90	61	132	134	137	151	167	184	203	225	248	274
Total	265	180	173	176	180	198	219	242	267	295	325	359
Total cash outflow												
Hotel rooms	254	176	33	33	33	40	42	22	24	27	30	33
Restaurants	130	90	78	79	80	104	114	114	126	139	154	170
Total	384	266	111	112	114	144	156	135	150	166	183	202
Net cash flow												
Hotel rooms	-79	-57	8	9	9	7	10	36	39	43	48	52
Restaurants	-40	-29	54	55	57	47	52	71	78	86	94	104
Grand total	-119	-86	62	64	66	54	62	106	117	129	142	157

Valuation Model of Project Portfolio under Uncertainty

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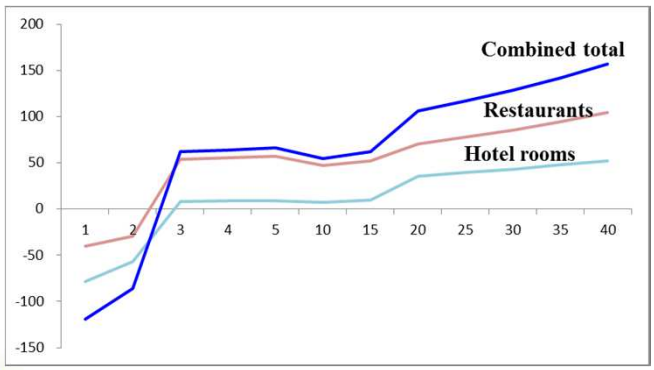
Research Objectives

- This paper shows how the traditional DCF may under- or over-estimate the risk of an investment portfolio.
- The Black and Scholes valuation model is used to verify the propositions described above.
- A case with simulation data is used to illustrate the approach and the findings support our arguments.
- Future research are recommended.

Tytpical Discounted Cash Flow Approach

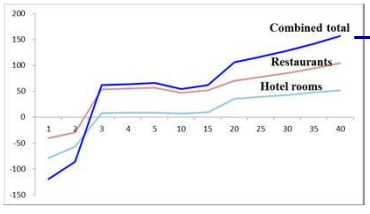
Revenues and costs of all the schemes in a project portfolio are usually integrated into one tied cash flow (a cash-flow bundle) to test the feasibility of the investment.



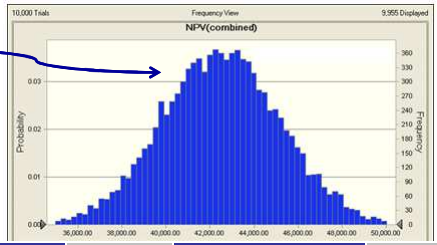
Tytpical Discounted Cash Flow Approach

In the risk analysis section, we change the assumptions for the parameters of each scheme in the base case to test the robustness of this project portfolio.

Risk assessment



Base case



Expected NPV	42,524	Standard deviation	2,638
Minimum NPV	31,912	Coefficient of variation	0.062
Maximum NPV	54,327		

Traditional DCF Model for Multiple Projects

the expected NPV of the combined cash flow is the expected value of the n possible NPVs determined by the m cash streams over a time period of T.

$$\overline{NPV}_{bundle} = \sum_{j=1}^{n} E(NPV_j) = \sum_{j=1}^{n}\sum_{t=1}^{T}\sum_{i=0}^{m} \frac{CF_{jit}}{(1+r_i)} - I_{it} = V_{bundle} - I_{bundle}$$

Expected combined NPV

Possible NPVs determined by the m cash streams (CF_{jit}) over a time period of T

Adding the Managerial Flexibility value

- **As a complement to the traditional DCF method, the real option model adds the value of the managerial flexibility in making decisions and the innovation capability into the underlying project.**
- **The manager can choose to defer, expand, or abandon the project in response to unexpected market changes. The value of the flexibility contributes additional value to the NPV of the underlying project.**
- **the expanded NPV of the project is the sum of its passive NPV and a combined option value (Trigeorgis, 1993)**

$$TV_{bundle} = NPV_{bundle} + C_{bundle}$$

The real option model based on Black-Scholes Model

- The real option pricing model has been used to evaluate the managerial flexibility in corporate and project investment (e.g., Carlson, Fisher & Giammarino, 2006; Grullon, Lyandres & Zhdanov, 2012; Yeo & Qiu, 2003)
- Equation (4) illustrates a real option function based on the Black-Scholes option model used to estimate the value of the managerial flexibility in investment decisions.

$$dV_{bundle} = \mu V_{bundle} dt + \sigma_{bundle} V_{bundle} dw$$

the expected value of assets is a stochastic variable with the geometric Brownian motion.

$$d_1 = \frac{\ln\left(\frac{V_{bundle}}{I}\right) + \left(r + \frac{\sigma_{bundle}^2}{2}\right)\tau}{\sigma_{bundle}\sqrt{\tau}}$$

$$C_{bundle} = V_{bundle} N(d_1) - I_{bundle} e^{-rT} N(d_2)$$

$$\tau = T - t$$

$$d_2 = \frac{\ln\left(\frac{V_{bundle}}{I}\right) + \left(r - \frac{\sigma_{bundle}^2}{2}\right)\tau}{\sigma_{bundle}\sqrt{\tau}} = d_1 - \sigma_{bundle}\sqrt{\tau}$$

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The Variance of The cash Flow Bundle

- The variance of the cash flow bundle of the project portfolio is the degree of diversification of all the possible outcomes from the expected outcome .
- The traditional DCF method directly examines the risk of the investment portfolio based on one cash flow bundle and ignores the covariance among projects.

$$\sigma_{bundle}^2 = \frac{\sum_{j=1}^{m} \left(NPV_{bundle,\,j} - E\left(NPV_{bundle}\right)\right)^2}{m}$$

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Valuation Model for Project Portfolio Consisting of Two Schemes

- The expected NPV of the project portfolio is a weighted average of the expected NPVs of schemes A and B, with w_A and w_B as the weights.
- the variance of the NPV on the two-scheme portfolio is the sum of the variances of schemes A and B, plus the covariance between these two schemes ($2w_A w_B \rho_{AB} \sigma_A \sigma_B$).

$$\mathrm{E}(V_P) = w_A E(V_A) + w_B E(V_B)$$

$$\sigma_P^2 = (w_A\sigma_A + w_B\sigma_B)^2 = {w_A}^2{\sigma_A}^2 + {w_B}^2{\sigma_B}^2 + 2w_A w_B \rho_{AB}\sigma_A\sigma_B$$

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Valuation Model for Project Portfolio Consisting of Two Schemes

- The value and investment cost of the underlying assets to be built by schemes.

$$dI_i = \mu I_i dt + \sigma_i I_i dz_2 \;;\quad dV_i = \mu V_i dt + \sigma_i V_i dz_1$$

- The managerial decision values for the two schemes can be measured individually using the real option model.

$$\begin{cases} C_A = V_A N(d_{11}) - I_A e^{-r\tau} N(d_{12}) \\ C_B = V_B N(d_{21}) - I_B e^{-r\tau} N(d_{22}) \end{cases}$$

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Valuation Model for Project Portfolio Consisting of Two Schemes

- The case of the combined cash flow bundle

$$C_{bundle} = V_{bundle} N(d_{bundle1}) - I_{bundle} e^{-r\tau} N(d_{bundle2})$$

- Relations

$C_p > C_{bundle}$ if $\rho_{AB} > 0$

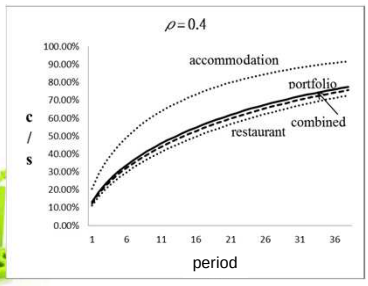
$C_p = C_{bundle} = C_A + C_B$ if $\rho_{AB} = 0$

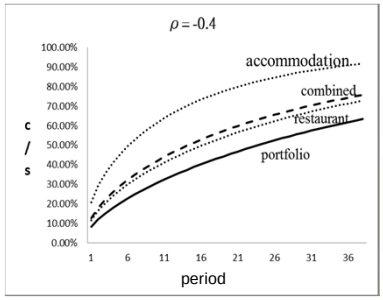
$C_p < C_{bundle}$ if $\rho_{AB} < 0$

management flexibility value for the project portfolio (C_p) can be larger, equal, or smaller, than that for the project bundle (C_{bundle}) depending on the correlation coefficient.

The simulation results

- The simulation results of the hotel and restaurant investment program
  - The value of managerial value of the cash flow portfolio is higher (lower) than that of the combined cash flow when the correlation coefficient between the two streams is positive (negative).





Conclusions and Future Research

- The practitioners usually combine the cash streams of various businesses into one cash flow bundle, which does not account for the correlation between the businesses.
- With the Black-Scholes model, we have shown that this approach may over or under estimate the managerial flexibility value depending on the correlation coefficient.

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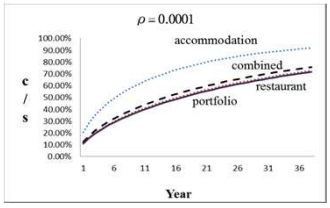
Conclusions and Future Research

- However, the empirical study shows that the numerical managerial flexibility value of the combined cash flow is higher that on the cash flow portfolio when the correlation coefficient between the two streams close to 0.
- This result indicate the operational simulation procedure may over estimate the risk of the combined cash flow in some circumstances. An adjusted simulation approach will be needed.



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Q&A

Thank you for listening.

國科會補助計畫衍生研發成果推廣資料表

日期:2013/10/27

國科會補助計畫	計畫名稱: 競爭異質性軌跡之研究－動態資源構形模型
	計畫主持人: 劉芬美
	計畫編號: 99-2410-H-263-008-MY3　　學門領域: 策略管理

無研發成果推廣資料

99 年度專題研究計畫研究成果彙整表

計畫主持人：劉芬美	計畫編號：99-2410-H-263-008-MY3
計畫名稱：競爭異質性軌跡之研究－動態資源構形模型	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	2	2	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	3	3	100%	人次	
		博士生	0	0	100%		
		博士後研究員	1	1	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	1	1	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	無

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

□實驗失敗

□因故實驗中斷

□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：□已發表 ■未發表之文稿 □撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：(以 100 字為限)

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）(以 500 字為限)

策略管理相關研究之核心為探討持續性競爭優勢之特性及來源，目前學者普遍以財務績效高於產業平均決定企業是否存在競爭優勢，然而財務績效僅代表企業在當年度之經營成果，可能會受運氣的影響，而選用不同的財務指標，也可能產生不同結論，故有偏誤之可能。持續性競爭優勢則是長期的，必須觀察企業是否持續有高於同業的績效。本研究利用潛在類別成長分析之羅吉斯模型，找出長期績效優於同業的公司。本研究為持續性競爭優勢提供一個有效的衡量方法，可作為研究持續性競爭優勢之特性與來源相關研究之基礎，