**COMPETITION DURING MARKET MELTDOWNS:
THE PERFORMANCE OF TELECOMMUNICATIONS EQUIPMENT
SUPPLIERS DURING 2001-2003**

by

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ABSTRACT

Little is known about how companies compete during market meltdowns -- a period of significant decline in economic activity spread across companies competing in an identifiable market, lasting more than 11 months, normally visible in stock price indices, sales, employment, and asset disposal. The objective of this thesis is to develop and test a model that relates competitive aggressiveness and company performance during market meltdowns and explains how top management heterogeneity, liquidity, and past performance affect company aggressiveness. A set of seven hypotheses is tested using 71 action years drawn from 36 suppliers of telecommunications equipment during 2001-2003. Company performance is measured in three ways: sales per employee, change in sales, and return on assets. The results show that action diversity is the only dimension of competitive aggressiveness that affects all three measures of company performance. The greater action diversity, the lower company performance. This thesis also provides a method to examine the antecedents and consequences of competitive aggressiveness using structural equations models.

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1 INTRODUCTION

The objective of this thesis is to develop and test a model that relates competitive aggressiveness and company performance during a telecom market meltdown and explains how top management heterogeneity (TMT), company liquidity, and past performance affect company competitive aggressiveness.

In this thesis, a market meltdown refers to a significant decline in economic activity spread across companies competing in an identifiable market, lasting more than 11 months, normally visible in stock price indices, sales, employment, and asset disposal. This definition of market meltdown builds on the definition of economic recessions provided by the National Bureau's Business Cycle Dating Committee in the United States (Hall et al., 2003).

There are two key differences between the definition of a market meltdown used in this thesis and the definition of economic recession. First, the duration of a market meltdown is greater than the average duration of the economic recessions in the United States. The Committee finds that the average duration of recessions in the United States since 1940 is 11 months. The duration of a market meltdown is defined to be greater than 11 months.

The second difference is in the indices used to declare whether a market meltdown is taking place. In this thesis a market meltdown is normally visible in stock price indices, sales, employment, and asset disposal. In the United States, the National Bureau's Business Cycle Dating Committee defines a recession as a significant decline in economic activity normally visible in real GDP, real personal income, employment, industrial production, and wholesale-retail sales.

The model developed in this thesis builds on Ferrier's competitive aggressiveness model (Ferrier, 2001), and the results of systematically examining news releases issued by suppliers of telecommunications equipment during 2001-2003.

Competitive aggressiveness is defined as the intensity and diversity of the actions undertaken by a company in order to compete during a market meltdown. For the purpose of this research, a company's competitive aggressiveness is comprised of the dollar amount of assets the company sells or disposes off, the number of employees it lets go, the total number of competitive actions it carries out (action volume), and the extent to which it undertakes a range of different action types (action diversity).

In this thesis, a TMT is defined as the group of individuals above the vice president level who are not regional presidents. This definition follows early research (e.g. Ferrier, 2001; Michel & Hambrick, 1992; Murray, 1989).

I focus on three firm-level factors that constrain and enable competitive aggressiveness: the degree to which members of the TMT are different with respect to working related backgrounds (TMT diversity), company liquidity, and company past performance. The research model used in this thesis is illustrated in Figure 1.

Figure 1. Antecedents and consequences of competitive aggressiveness during a market meltdown

During a market meltdown, competition is much more intense due to declining market opportunities (Dess and Beard, 1984; Lant et al., 1992). Knowing how to compete during a market meltdown is important to a company. It is surprising then to learn that I could not find a single empirical study on the relationship between competitive aggressiveness and company performance during market meltdown periods.

This thesis will be of particular interest to researchers working in the area of aggressive competitive strategies and to TMTs who are responsible for steering large global companies, like telecommunications equipments suppliers, during periods of market meltdown.

This thesis makes two contributions. First, it is the first empirical study on the relationship between competitive aggressiveness and company performance during a meltdown of the telecommunications market. The thesis expands the body of knowledge referred to as the aggressive competitive interaction stream at the action year level of analysis.¹ This stream is part of strategic management research.

The second contribution is that I develop an approach to examine competitive aggressiveness using data provided by companies that can be accessed online, structural

¹ An action year refers to the set of actions a company implements to compete with rivals during one year. For a review of the four levels of analysis of firm strategy as competitive action, see Ferrier (2001, p. 858-859).

equation modeling and Ferrier's framework.

The thesis is organized into seven chapters. Chapter 1 is the introduction. Chapter 2 provides the literature review and the lessons learned from it.

Chapter 3 develops the research model and seven hypotheses. Chapter 4 describes the research method. Chapter 5 provides the results obtained when testing the hypotheses. Chapter 6 discusses the results shown in the previous chapter. Chapter 7 provides the conclusions of the thesis, describes the limitations of this research, and suggests opportunities for future research.

2 REVIEW OF THE LITERATURE

Competitive aggressiveness affects company performance (Chen, 1996; Chen & Hambrick, 1995; Ferrier, 2001) and firm-level factors affect competitive aggressiveness (Ferrier, 2001; Ferrier, Smith & Grimm, 1999; Hambrick, Cho & Chen, 1996). Accordingly, this section is organized into four sections. The first section identifies the empirical studies on how firm-level factors affect a company's competitive aggressiveness and reviews the literature relevant to the effects of TMT heterogeneity, company liquidity, and past performance.

The second section reviews the empirical studies that examine the relationship between competitive aggressiveness and company performance. The third section of this study examines how to measure company performance. Finally, the fourth section identifies the key lessons learned from reviewing the literature

2.1 Firm-level factors and competitive aggressiveness

Table 1 identifies the empirical studies that examine how firm-level factors affect a company's competitive actions. For each empirical study, Table 1 identifies the sample used, the source of data, propositions tested, and the key results. In the column titled Proposition shown in Table 1, the "→" indicates that the study tested whether or not the variable that precedes the "→" affected the variable that follows it.

Table 1. Empirical studies that examine how top management team (TMT) diversity, company liquidity, and past performance affect competitive aggressiveness

Study	Sample	Data source	Proposition	Key results
Ferrier (2001)	16 largest firm-pairs across 16 industries from <i>Fortune</i> 500 during 1987-1993	F&S Predicasts; Dun & Bradstreet Reference Book of Corporate Management	TMT diversity → competitive aggressiveness; Liquidity → competitive aggressiveness; Past performance → competitive aggressiveness	TMT with high diversity had high attack complexity and duration. High level of liquidity enabled high attack volume and duration. Good past performance was negatively related to attack duration.
Fombrun, Ginsberg (1990)	177 companies in ten economic sectors during 1977-1984	COMPUSTAT	Past performance → competitive aggressiveness	Companies with poor and extremely good past performance were less likely to change aggressiveness than companies that experience intermediate past performance.
Hambrick, Cho, Chen (1996)	32 companies in airline industry during 1979-1986	Aviation Daily (industry journal)	TMT diversity → competitive action/response	TMT with high diversity was more likely to act/respond in noteworthy ways, but speed was low.
Hambrick, Geletkanycz, Fredrickson (1993)	690 executives from <i>Fortune</i> Industrial 500 and <i>Fortune</i> Service 500	Questionnaire	Past performance → commitment to status quo	Good past performance was more likely to make executives to commit to status quo.

Study	Sample	Data source	Proposition	Key results
Knight, Pearce, Smith, Olian, Sims, Smith, Flood (1999)	79 companies across industries in U.S and Ireland	Interview and questionnaire	TMT diversity → strategic consensus	TMT with high diversity had lower strategic consensus and high interpersonal conflict. Conflict and agreement seeking moderated the relationship between TMT diversity and strategic consensus.
Lant, Milliken, Barra (1992)	40 public companies in furniture industry and 40 public companies in computer software industry during 1984-1986	COMPUSTAT Industrial Data Base; 10K and annual reports	TMT diversity → strategic reorientation; Past performance → strategic reorientation; Environment + past performance → strategic reorientation	TMT diversity and poor past performance increased the likelihood of reorientation. Poor past performance was more strongly associated with reorientation in the stable environment than in the turbulent environment.
Miller, Chen (1994)	32 U.S. domestic airlines during 1979-1986	Aviation Daily; Airport Activity Statistics of Certified Route Carriers	Past performance → competitive inertia	Good past performance increased competitive inertia. Good past performance increased more inertia in tactical actions than in strategic actions.
Miller, Chen (1996)	18 largest airlines during 1979-1986	Aviation Daily; Airport Activity Statistics of Certified Route Carriers	Past performance → action simplicity	Good past performance increased the action simplicity.

Study	Sample	Data source	Proposition	Key results
Simons, Pelled, Smith (1999)	57 electronic components manufacturers in 1992	Questionnaire	TMT diversity + debate → decision comprehensiveness	TMT with debate enhance decision comprehensiveness.
Smith, Grimm, Gannon, Chen (1991)	32 U.S. domestic airlines during 1979-1986	Aviation Daily	Liquidity → response likelihood	High level of liquidity was negatively related to response likelihood.
Wiersema, Bantel (1992)	87 companies from <i>Fortune</i> 500 manufacturing in 1980	TRINET line-of-business data; Dun & Bradstreet Reference Book of Corporate Management	TMT diversity → propensity of changing company strategy	TMT with high diversity was more likely to change company strategies.

Top management team diversity

Top management team (TMT) diversity refers the degree to which its members are different with respect to working related backgrounds (Bunderson & Sutcliffe, 2002). These backgrounds include team member's company tenure background, function background, and education background (Blau, 1977; Hambrick, Cho, & Chen, 1996). Tenure diversity refers to the diversity in the years members of the TMT have spent in the company (Hambrick, Cho, & Chen, 1996). Function diversity represents the diversity in the different functional areas within which team members have spent the greater part of their careers (Bunderson & Sutcliffe, 2002). Education diversity represents the diversity at educational level that team members had undertaken (Hambrick, Cho, & Chen, 1996).

The TMT is key to problem sensing and decision-making (Sutcliffe, 1994). A TMT with a high diversity has broad cognitive knowledge and wider field of vision to sense problems and observe more opportunities in turbulent industries (Bantel, 1993; Ferrier 2001; Hambrick, Cho, & Chen, 1996; Knight et al., 1999).

A diverse TMT has high propensity to make competitive moves to solve company problems and exploit opportunities (Hambrick, Cho, & Chen, 1996). With broad information and experience, a diverse team can generate clear strategies by combining team members' orientations (Bantel, 1993). Once a TMT with high diversity reaches

consensus and clarity on a strategy, their actions are more likely to be significant (Hambrick, Cho, & Chen, 1996). Significant actions involve larger outlays, greater departures from status quo, and are difficult to reverse (Chen, Smith, & Grimm, 1992; Ghemawat, 1991). A diverse TMT tends to implement bolder actions.

Typically, a diverse TMT experiences difficulty when sharing information and communicating. It has more conflicts due to disparate vocabularies and perspectives. A diverse TMT has lower rate of strategy consensus (Knight et al., 1999). In addition, a diverse TMT slows down the speed of execution because wide-ranging information and opinions require more time to process (Hambrick, Cho, & Chen, 1996). A diverse TMT has a low consensus rate and low execution speed. This constrains the volume of competitive actions a company undertakes (Ferrier, 2001). By contrast, a homogenous TMT undertakes more actions in their field and executes these actions faster.

A diverse TMT possesses a greater ability to generate more complex solutions for strategic actions because it has comprehensive knowledge and can make decisions based on conflict debate and advocacy (Simons, Pelled, & Smith, 2000). Such decision-making complexity leads to “diversity, novelty, and comprehensiveness in the set of recommended solutions” (Wiersema & Bantel, 1992). Research found that a diverse TMT is more likely to make strategic reorientation and complex decisions (Lant, Milliken, & Batra, 1992; Wiersema & Bantel, 1992). In contrast, a homogeneous TMT designs and

implements simple strategies and actions with low diversity (Miller, 1993; Miller & Chen, 1996).

Liquidity

Company liquidity refers to organizational slack. Company liquidity is defined as “the cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressure for change in policy as well as to initiate change in strategy with respect to external environment” (Bourgeois, 1981).

A company’s capability to execute competitive moves depends on its resource availability (Bourgeois, 1981; Smith et al., 1991). High levels of slack give the company more resources to execute a large number of actions or responses under competitive pressures when actions/responses are needed (Ferrier, 2001; Yong, Smith, & Grimm, 1996).

A high level of liquidity also gives the company ability to experiment with a larger number of strategic innovations (Cyert & March, 1963) and explore new strategies (Hambrick & Snow, 1977). In contrast, low levels of slack impede the company to have necessary resources for making competitive activities and innovations (Smith et al., 1991; Yong, Smith, & Grimm, 1996).

Past performance

A company's past performance is a predictor of its future actions (Ferrier, 2001; Lant, Milliken, & Batra, 1992; Thompson, 1967). Managers tend to be content with existing routines and action patterns, which leads to inertia (Miller & Chen, 1994). Therefore, good past performance reduces managers' motivation for implementing strategic changes or new types of actions (Lant, Milliken & Batra, 1992). Good past performance reduces the motivation to search for opportunities (Miller, 1994). This induces competitive simplicity (Miller & Chen, 1994).

Poor past performance makes the TMT feel vulnerable to unfriendly takeovers, internal upheavals, and job losses (James & Soref, 1981). Poor past performance motivates managers to implement more change and take a larger number of competitive actions.

2.2 Competitive aggressiveness and company performance

Ferrier (2001) defines competitive aggressiveness from an action-based head-to-head rivalry perspective. Schumpeter's theory of creative destruction describes head-to-head rivalry as "an incessant race to get or to keep ahead of one another" (Schumpeter, 1950). Companies compete aggressively to find new ways to satisfy customers in order to get ahead of competitors (D'Aveni, 1994; Schumpeter, 1950). Kirzner (1973) describes

this type of actions as “creating new ways of doing things and new things to do.”

Competitive aggressiveness ultimately impacts a company’s financial performance.

Table 2 identifies the empirical studies focused on how competitive aggressiveness affects a company’s performance.

Table 2. Empirical studies that examine how competitive aggressiveness affects company performance

Study	Sample	Data source	Proposition	Key results
Ferrier (2001)	16 largest firm-pairs across 16 industries from <i>Fortune</i> 500 during 1987-1993	F&S Predictcasts; Dun & Bradstreet Reference Book of Corporate Management	Competitive aggressiveness (attack volume, attack duration, attack complexity, attack unpredictability) → relative performance (market share)	Attack volume and attack duration increased companies' relative performance. Attack complexity and unpredictability exhibited U-shaped relationship with relative performance.
Ferrier, Smith, Grimm (1999)	41 leader/-challenger company-pairs in 41 industries during 1987-1993	COMPUSTAT; <i>F & S Predictcasts</i>	Leader/challenger action volume → market share gap erosion; Leader/challenger action complexity → market share gap erosion	Leaders that carry out more competitive actions than challengers had lower rate of market share gap erosion. Leaders that have complex action repertoires had lower rate of market share gap erosion.
Hambrick, Schechter (1983)	260 companies in mature industries during 1979-1982	Profit Impact of Market Strategies (PIMS) data base	Magnitude of strategic moves (asset reduction, cost cutting, revenue generation, product/market refocusing) → performance	Asset reduction and cost cutting moves were associated with successful short-term turnaround (return on asset) in mature industries.

Study	Sample	Data source	Proposition	Key results
Miller, Chen (1994)	32 U.S. domestic airlines during 1979-1986	Aviation Daily; Airport Activity Statistics of Certified Route Carriers	Competitive inertia → performance	High inertia in strategic actions increased near-term performance, but inertia in tactical actions had no effects. However, the benefits from inertia in all kinds of action diminished with increases in market diversity.
Miller, Chen (1996)	18 largest airlines during 1979-1986	Aviation Daily; Airport Activity Statistics of Certified Route Carriers	Competitive complexity → performance	Competitive complexity benefited performance, especially during periods of uncertainty and growth.
Smith, Grimm, Gannon, Chen (1991)	32 U.S. domestic airlines during 1979-1986	Aviation Daily	Response likelihood → performance	The likelihood of response is positively associated with performance.
Yong, Smith, Grimm (1996)	345 company-year observations from public single-business companies in U.S. computer software industry during 1983-1991	SEC filing; F & S Predicasts	Competitive action volume → performance	As competitive activity volume increases, company performance increases.

Action types

In empirical studies on company turnaround strategies, competitive actions have been classified into four types: asset reduction, cost cutting, revenue generation, and product/market refocusing (Hambrick & Schechter, 1983; Hofer, 1980). Asset reduction and cost cutting are two action types that are unique to studies on turnaround strategy. Asset reduction actions involve disposal of assets – primarily fixed assets. Cost cutting actions involve cutbacks in administrative, R&D, marketing, and other seeming discretionary expenses. Revenue generating actions are the actions that attempt to increase sales by some combinations of product introductions, increased advertising, increased selling efforts, and lower prices. Product/market refocusing actions involve shifting emphasis into defensible niches.

Miller & Chen (1994) studied the U.S airline industry during the 1979-1986 timeframe, a period of market growth. They distinguished between two action types: strategic and tactical actions. Strategic actions involve a larger expenditure of resources, a longer time horizon, and a greater departure from the status quo than do tactical actions (Galbraith & Kazanjian, 1986; Dutton & Duncan, 1987). Strategic actions include facility expansions, mergers and acquisitions, strategic alliances, and important new products or services. Tactical actions include price changes, advertising campaigns, and incremental product or service adjustment (Miller & Chen, 1994).

In competitive aggressiveness studies, corporate action types are classified into six types: marketing actions, capacity actions, new product actions, signaling actions, pricing actions, and service actions (Ferrier, 2001; Ferrier, Smith, & Grimm, 1999). Ferrier (2001) uses these six action types to measure the four dimensions of competitive aggressiveness: attack volume, attack duration, attack complexity, and attack unpredictability.

Asset disposal

Asset disposal helps a company focus on its core business (Canals, 2000; Zook, 2001). When faced with a prolonged decline in performance, a company must develop a turnaround strategy to respond to the crisis. Frequently, companies decide to dispose assets. When facing a market downturn, asset disposal activities may be more efficient than product/marketing actions in achieving short-term turnaround success (Hambrick & Schechter, 1983; Hofer, 1980).

During slow market growth periods, companies within an industry experience fewer opportunities (Dess & Beard, 1984). To adapt to market changes, these companies need to redefine their core business (Zook, 2001). To improve profitability, companies need to align their capacity and core business with existing marketplace realities (Canals, 2000; Doorley & Donovan, 1999; Zook, 2001).

Headcount reduction

Headcount reduction is an action classified as a cost-cutting action in the empirical studies on turnaround strategies. When a company operates below its breakeven point, cost cutting moves increase the rate of successful turnaround with improvement on return on asset (ROA) and market share (Hofer, 1980; Hambrick & Schechter, 1983).

A company needs to keep the right people operating the core businesses and dispose of unnecessary headcount (Canals, 2000; Zook, 2001).

Action volume

A company that carries out more competitive actions than its rivals over a time period is defined as competitively more aggressive and is expected to perform better (Ferrier, 2001; Ferrier, Smith, & Grimm, 1999; Yong, Smith, & Grimm, 1996). Industry growth influences action volume (Dess & Beard, 1984; Sutcliffe, 1994). Slow growth motivates companies to increase the volume of competitive actions (Ferrier, Smith, & Grimm, 1999; Lant, Milliken, & Batra, 1992; Smith, Grimm, & Gannon, 1992). Companies that carry out more actions than competitors can explore more opportunities and close off potential actions by rivals. Aggressive companies experience higher profitability (Smith et al., 1991; Yong, Smith, & Grimm, 1996) and greater market share (Ferrier, 2001) than less aggressive companies.

Action diversity

Action diversity refers to the extent to which a company carries out a range of competitive actions (Kirzner, 1973; Schumpeter, 1950). Companies that carry out a wide range of action types are defined to be more aggressive. They experience high levels of performance because they may have a more complex resource base that confers multiple advantages (Ferrier et al., 1999; Miller & Chen, 1996).

Ferrier argues that action diversity exhibits a U-shaped relationship with a company's performance (Ferrier, 2001). At a low level of action diversity, the TMT is able to make decisions quickly and implement a few different types of competitive actions that improve performance. As the level of action diversity increases, the complexity of decision comprehensiveness reduces decision-making and implementation speed (Lumpkin & Dess, 1995; Simons, Pelled, & Smith, 1999). This lowers a company's performance. As the level of action diversity continues to increase, a company that is able to undertake many different types of actions may be able to suppress competitors' capability of competing and responding quickly, thereby enhancing the company's performance (Ferrier, 2001).

2.3 Company performance measures

Table 3 identifies the measures of performance used in empirical studies focused on industry growth.

Table 3. Measures of performance used in empirical studies on industry growth

Study	Studied industries	Measures of industry performance
Dess & Beard (1984)	52 manufacturing industries during 1968-1977	1) Growth in sales; 2) Growth in price-cost margin; 3) Growth in total employment; 4) Growth in value added; 5) Growth in number of establishments
Ferrier (2001);	16 industries during 1987-1993	Growth in gross sales in industry
Ferrier, Smith, & Grimm (1999)	41 industries during 1987-1993	Growth in gross sales in industry
Keats & Hitt (1988)	Manufacturing industries during 1969-1973	1) Growth in industry net sales; 2) Growth in operating income in the dominant industry
Miller & Chen (1994); Miller & Chen (1996)	U.S. airline industry during 1979-1986	Growth in total industry volume (growth in total revenue passenger miles)

2.4 Lessons from the literature review

Three key lessons were learned from undertaking the literature review.

First, empirical studies on how to increase company performance during market meltdowns do not exist. The studies identified in Tables 1 and 2 focus on stable, turbulent or growing markets.

Second, prior studies use samples drawn from traditional industries or cross-industries. Table 1 and Table 2 show that no empirical studies have examined the telecommunications industry.

Third, past researchers use databases that are collected and massaged by third parties. Table 1 and Table 2 show that no study has used data directly published online by the companies included in the sample.

3 HYPOTHESES DEVELOPED

This chapter is organized into two sections. The first section identifies the differences between the research model used in this research and Ferrier's model (Ferrier 2001). The hypotheses are developed in the second section.

3.1 Differences between my model and Ferrier's model

The research model in this study is built using the logic used by Ferrier to construct his model (Ferrier 2001). However, there are three differences between the model used in this research and Ferrier's model. First, my research model was designed specifically to study competition during market meltdowns; Ferrier's model was not. For this reason my model includes two variables not included in Ferrier's model: asset disposal and headcount reduction. These two competitive actions occur repeatedly across the industry in a market meltdown. Asset disposal actions occur because during a market meltdown a company must focus on its core business or large revenue market segments. Headcount reduction actions occur because the company must cut costs to improve its performance.

The second difference between the two models is that Ferrier studied company competition between paired companies. My research does not examine paired company

competition. Ferrier selects two companies in each of 16 industries. One company is a focal company that carries out competitive attacks; the other company is the focal company's rival that carries out competitive responses. My research studied the competition of 36 telecom companies under the same market meltdown circumstance.

The third difference between Ferrier's and my research model is that company performance is measured in different ways. In my model, company performance is measured in three ways, sales per employee, change in sales, and return on assets. In Ferrier's (2001) model, company performance is measured as change in sales. Change in sales is commonly used to indicate company performance during market growth period. However, telecom industry experts and literature that examines company downturns suggested that during market meltdown, sales per employee and return on assets are the most important indicators that guide the actions of top managers.

3.2 Hypotheses development

Seven sets of hypotheses anchored around the model shown in Figure 1 were developed.

When operating under a market meltdown condition, a TMT frequently readjust its business by divesting assets (Hofer, 1980). A TMT with high diversity may experience high interpersonal conflicts due to different perspectives and have difficulty arriving at a strategic consensus (Knight et al., 1999). Team diversity slows down a company's response speed to environmental change (Hambrick, Cho, & Chen, 1996). I posit that during market meltdowns, high diversity teams will have difficulty deciding which assets to divest and will dispose off fewer assets than low diversity teams. Therefore,

H 1at: TMT tenure diversity is negatively related to asset disposal.

H 1af: TMT function diversity is negatively related to asset disposal.

H 1ae: TMT education diversity is negatively related to asset disposal.

Typically, headcount reduction is associated with asset disposal during a turnaround strategy (Hofer, 1980; Hambrick & Schechter, 1983). A TMT with high diversity has difficulty agreeing on which employees to lay off for the same reasons it has difficulties deciding on which assets to divest. Therefore,

H 1bt: TMT tenure diversity is negatively related to headcount reduction.

H 1bf: TMT function diversity is negatively related to headcount reduction.

H 1be: TMT education diversity is negatively related to headcount reduction.

A TMT with high diversity experiences high interpersonal conflicts (Knight et al., 1999). These conflicts need more time to be resolved. This slows down a TMT's

decision-making speed (Jackson, 1992) and action-execution speed (Hambrick, Cho, & Chen, 1996). Therefore, TMT diversity diminishes the efficiency and ability to sustain a large number of serial actions (Ferrier, 2001). In contrast, a homogeneous TMT is capable of taking greater number of actions when potential actions fall within the team field of vision, preferences, and repertoire. Once homogeneous teams reach a consensus in their field, they can act quickly (Hambrick, Cho, & Chen, 1996). Therefore, they can increase the volume of actions that fall in their working background field. Therefore,

H 1ct: TMT tenure diversity is negatively related to action volume.

H 1cf: TMT function diversity is negatively related to action volume.

H 1ce: TMT education diversity is negatively related to action volume.

TMT with high diversity is better able to deal with strategic complexity and aggressiveness (Ferrier, 2001; Lant, Milliken, & Batra, 1992; Wiersema & Bantalt, 1992). They tend to carry out a broad range of competitive actions to match their complex strategy. Therefore,

H 1dt: TMT tenure diversity is positively related to action diversity.

H 1df: TMT function diversity is positively related to action diversity.

H 1de: TMT education diversity is positively related to action diversity.

High liquidity permits companies to have buffer resources for potential usage or development (Bourgeois, 1981). When operating in a market meltdown situation,

companies with high liquidity may be able to support a broader range of competitive actions than those companies with low liquidity. Before companies with low liquidity can invest in a broad range of competitive actions they must improve their liquidity position first. They may have to divest or exit from current low profit businesses even if these businesses have high growth potential in future. Therefore,

H 2a: High levels of liquidity are negatively related to asset disposal.

Headcount reduction is closely linked to company's asset disposal. When companies with high liquidity maintain more businesses, they also need the human resources to support these businesses. For companies with low level of liquidity, headcount reduction is one quick way to improve their liquidity situation. Therefore,

H 2b: High levels of liquidity are negatively related to headcount reduction.

Companies with high levels of liquidity have the ability to execute a greater number of actions (Ferrier, 2001; Yong, Smith, & Grimm, 1996). They respond faster and more effectively to environmental threats than companies with low levels of liquidity (Meyer, 1982). Therefore,

H 2c: High levels of liquidity are positively related to action volume.

High liquidity protects a company from its environment (Thompson, 1967). When operating in a market meltdown, companies with high liquidity are still able to maintain

their sophisticated and a broad range of activities for current and future business development. Companies with low liquidity find it difficult to pay for costly activities.

They are constrained to execute a narrow range of action types. Therefore,

H 2d: High levels of liquidity are positively related to action diversity.

Good past performance reduces companies' motivations to undertake a larger number of competitive actions and implement strategic change (Ferrier, 2001; Hambrick & Schechter, 1983). Managers are satisfied with their companies existing routines and business structures. They make fewer changes in business segments and headcount adjustments. They follow past action behaviors to compete on the market, not likely to increase the number of actions or execute new types of actions. In contrast, during meltdown situations, companies with poor past performance are motivated to make changes and find effective competitive moves to improve performance. They also tend to readjust business to focus on high growth areas and dispose of low yielding assets. Therefore,

H 3a: Good past performance is negatively related to asset disposal.

H 3b: Good past performance is negatively related to headcount reduction.

H 3c: Good past performance is negatively related to action volume.

H 3d: Good past performance is negatively related to action diversity.

When their market environments deteriorate, companies respond to competitive pressures by divesting assets to realign core business on larger revenue, profitable businesses (Hofer, 1980; Zook, 2001). I reason that under market meltdown situations, top managers focus company resources on the opportunities that generate larger revenue and profits, and dispose off businesses that are far below their financial break-even point (Hambrick & Schechter, 1983). To achieve this objective, company exits non-core product lines or business units, non-strategic R&D development, and adjacent services. Through asset divesting, companies can gain better performance than those companies that cannot realign their operations to the core businesses (Hambrick & Schechter, 1983). Therefore,

H 4a: Asset disposal is positively related to sales per employee.

H 4b: Asset disposal is positively related to change in sales.

H 4c: Asset disposal is positively related to return on assets.

Asset disposal usually involves cost cutting moves (Hofer, 1980). Laying off employees is one of these cost cutting moves. Cost cutting is efficient in improving a company's turnaround performance (Hambrick & Schechter, 1983). Therefore,

H 5a: Headcount reduction is positively related to sales per employee.

H 5b: Headcount reduction is positively related to change in sales.

H 5c: Headcount reduction is positively related to return on assets.

Researchers suggest that companies that undertake a larger number of actions experience better performance in profitability and market share (Ferrier, 2001; Smith et al., 1991; Yong, Smith, & Grimm, 1996). A large number of competitive actions enable a company to explore more opportunities, strengthen customer and investor relationships, and enhance its market position. Therefore,

H 6a: Action volume is positively related to sales per employee.

H 6b: Action volume is positively related to change in sales.

H 6c: Action volume is positively related to return on assets.

When a company undertakes a narrow range of competitive actions it eases top managers' decision-making and quickens execution speed. When a company undertakes a variety of action types, the TMT needs more time to process more information and solve conflicts and debates on decision-making and execution. This low efficiency may lower company performance. Therefore,

H 7a: Action diversity is negatively related to sales per employee.

H 7b: Action diversity is negatively related to change in sales.

H 7c: Action diversity is negatively related to return on assets.

The relationship between action diversity and company performance proposed in this study differs from the one proposed by Ferrier (2001). Ferrier suggests that action diversity exhibits a U shape relationship with company performance. His rationale is

that while action diversity initially may lower company performance, the company will be able to increase its performance when managers become fluent at undertaking complex actions. However, under market meltdown circumstance, I argue that action diversity exhibits a negative relationship with company performance. During a market meltdown, speed and efficiency are crucial for survival. A company must improve its performance quickly.

In summary, the hypotheses in this research are listed below:

H 1at: TMT tenure diversity is negatively related to asset disposal.

H 1af: TMT function diversity is negatively related to asset disposal.

H 1ae: TMT education diversity is negatively related to asset disposal.

H 1bt: TMT tenure diversity is negatively related to headcount reduction.

H 1bf: TMT function diversity is negatively related to headcount reduction.

H 1be: TMT education diversity is negatively related to headcount reduction.

H 1ct: TMT tenure diversity is negatively related to action volume.

H 1cf: TMT function diversity is negatively related to action volume.

H 1ce: TMT education diversity is negatively related to action volume.

H 1dt: TMT tenure diversity is positively related to action diversity.

H 1df: TMT function diversity is positively related to action diversity.

H 1de: TMT education diversity is positively related to action diversity.

H 2a: High level of liquidity is negatively related to asset disposal.

H 2b: High level of liquidity is negatively related to headcount reduction.

H 2c: High level of liquidity is positively related to action volume.

H 2d: High level of liquidity is positively related to action diversity.

H 3a: Good past performance is negatively related to asset disposal.

H 3b: Good past performance is negatively related to headcount reduction.

H 3c: Good past performance is negatively related to action volume.

H 3d: Good past performance is negatively related to action diversity.

H 4a: Asset disposal is positively related to sales per employee.

H 4b: Asset disposal is positively related to change in sales.

H 4c: Asset disposal is positively related to return on assets.

H 5a: Headcount reduction is positively related to sales per employee.

H 5b: Headcount reduction is positively related to change in sales.

H 5c: Headcount reduction is positively related to return on assets.

H 6a: Action volume is positively related to sales per employee.

H 6b: Action volume is positively related to change in sales.

H 6c: Action volume is positively related to return on assets.

H 7a: Action diversity is negatively related to sales per employee.

H 7b: Action diversity is negatively related to change in sales.

H 7c: Action diversity is negatively related to return on assets.

4 RESEARCH DESIGN

4.1 Unit of analysis

The unit of analysis is one company action year. A company action year is comprised of the competitive actions undertaken by a company during one fiscal year.

Companies' fiscal years start in different months. Thus, the starts of two companies' fiscal years may not be in the same calendar month.

4.2 Study period

The study period is from January 2001 to October 2003.

During the study period, 36 telecommunications equipment suppliers:

- reduced their number of employees from 897,000 to 589,000, a 34% of decline
- sold assets worth 89 billion US dollars
- reduced sales from 241 billion US dollars to 163 billion US dollars, a 33% reduction

The numbers given above were calculated from the companies' filings with the Securities and Exchange Commission. In addition, the historical chart of Dow Jones US Telecommunications Index dropped 66% from April 2000 to the end of 2003.

The Dow Jones US Telecommunications Index is one of a comprehensive world index family designed to provide international investors portfolio management and benchmarking tools. There are 17 US telecom service providers in the Dow Jones US Telecommunications Index. Figure 2 shows the index from January 2000 to February 2004. Figure 2 shows that the period selected for this study falls within a prolonged period of complete market collapse. The market prices of telecommunication service providers declined from April 2000 to March 2003 and remained at low levels all through 2003.

Figure 2. Dow Jones Telecommunications Index: 2000-2004

Source: (Yahoo Finance web site, <http://finance.yahoo.com/q/bc?s=DJUSTL&t=5y/>).

4.3 Sample

Sample selection

The sample is comprised of company action years drawn from suppliers of telecommunications equipment that are listed in the NYSE, sell to public service providers and telecom carriers, and have financial data and new releases for the January 2001 to October 2003 period.

To select the companies that contributed the action years included in the sample, I followed a five-step process. First, I selected a comprehensive online directory that lists suppliers of telecommunications equipment. I used the directory under the path of: Industries > Communications Equipment > Company Index in the Yahoo! Finance web site that can be accessed at: <http://finance.yahoo.com/>. The companies in the directory include: equipment for public service providers and non-public service providers, communication test and measurement, components for communication equipment makers, software applications for communications, and customer premise equipment for communications.

In the second step, I identified all the suppliers in the online directory that were listed in the New York Stock Exchange.

In the third step, I selected the companies that sold directly to telecom carriers or public service providers. This ensured that all companies in the sample were affected by the market meltdown conditions of 2001-2003.

In the fourth step, I eliminated those companies for which financial data was not available for the study period. The companies eliminated were companies that had become public companies after 2001.

In the fifth step, I eliminated from the sample those companies that did not maintain their news releases on their websites.

4.4 Data collection

Data were collected from the following sources:

Dow Jones US telecom index

The Dow Jones US telecom index was obtained from the Yahoo! Finance web site (<http://finance.yahoo.com/>). This website stores historical stock prices and indices. By entering the index symbol (^DJUSTL), the historical price chart for the Dow Jones US

telecom index can be obtained.

Company data

Company data was obtained from the company's filings with the United States Securities and Exchange Commission (SEC). All companies in the sample provide online access to their United States SEC filings.

The company data collected from the SEC filings are:

1. Company's current assets, inventory, current liability, total assets (listed in the company's balance sheet)
2. Sales, gross profit, net income (listed in the company's income statement)
3. Amount of asset disposal (listed in the section of investing activity on the company's cash flow statement). Amount of asset disposal includes proceeds on sale of investments, securities, and businesses, as well as proceeds on disposals of plant and equipment
4. Number of employees (listed in the section of the company's employees)

Action events

Information on companies' action events was collected from the news releases in the website maintained by companies. I examined news releases from all companies in the

sample, and classified actions into nine types:

1. Asset and business disposal

Activities on asset and business disposal include divesting manufacturing facilities, product lines, business units, plants and equipment, investments in other companies, and marketable securities and investment.

2. Headcount reduction

Headcount reduction refers to reducing the number of employees that work for the company.

3. Changes in TMT and company's board of directors

This action refers to making changes in the TMT membership, board directors or Chief Executive Officer.

4. Alliances, mergers and funding new ventures

These actions include establishing market and sales alliance, R&D alliance, creating new ventures or funding in existing ventures for R&D, merging companies for market share and R&D

5. Investing in locations to support core customers

Investing in locations for core customer support includes investing activities on R&D facilities, manufacturing, and integration/logistic capabilities.

6. Financing

Financing activities include raising capital, amending credit facilities, providing guarantees, share splitting/converse, reducing or eliminating dividends.

7. Fighting lawsuits and SEC investigations

8. Product and technology trials

Product and technology trials are the activities that company products are being tested or experimented to determine their quality, safety, performance, usefulness, interoperability, or customer acceptance. Trials include product trials for customers and trials between vendors' products.

9. New product introduction and new features on existing products

TMT backgrounds

Information on the tenure, function and education of TMTs was collected from the section in the company's website that introduces company's executives and from the company's financial SEC filings in the sections that provide background information on executives.

When background information on a TMT member was not in the company's website or in the SEC filings, the information was found using Internet search tool Google (www.google.com).

4.5 Variable measurement

4.5.1 Firm-level factors

TMT diversity

In this thesis, a TMT is defined as the group of individuals above the vice president level who are not regional presidents. The executives who are regional presidents were eliminated because they focus mainly on regional sales activities but not on corporate strategy. This follows early research (e.g. Ferrier, 2001; Michel & Hambrick, 1992; Murray, 1989).

When there were changes in the TMT within a fiscal year, to be considered part of the TMT in this research, the executive needed to have at least six months tenure. Members with more than six months tenure in an action year were included as TMT members because they were assumed to have made a greater impact on company performance than those with less than six months on the job.

TMT diversity was measured in three ways:

- Company tenure diversity
- Function diversity
- Education diversity

Company tenure diversity was calculated as the standard deviation divided by the mean for the number of years the executives on the TMT had spent in the company (Ferrier, 2001; Wiersema & Bantel, 1992). High scores indicate that TMT is diverse with respect to members' working years in the company.

Function diversity was measured by a variation of Herfindal-Hirschman index proposed by Blau (1977):

$$H = 1 - \sum_{i=1}^9 (p_i)^2$$

where H is the dominant function diversity measure, and p is the percentage of TMT members in each of 9 working experience background categories. These categories include: sales or marketing, operation/field service, finance or accounting, engineering/R&D, personnel/HR, General counsel/secretary, public relations, general management, and other. High scores indicate that TMT is composed of members with different functional backgrounds.

Education diversity is measured by the same formula as function diversity, but p is percentage of TMT members in 6 different disciplines (used by Blau, 1977), Engineering, Science, Business, Liberal Arts, Law, and Other. High scores suggest that the TMT is educationally diverse.

Liquidity

The quick ratio was used to measure liquidity (Smith et al., 1991). The formula for calculating the quick ratio used was:

$$\text{Quick Ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$$

Liquidity is lagged by one year (Hambrick, Cho, & Chen, 1996). Thus, the quick ratio to be used for time T, is the value of the quick ratio at T-1.

Past performance

Past performance is a predictor variable for company taking competitive actions (Ferrier 2001; Wiersema & Bantel, 1992). Return on assets is lagged one year. The formula used is shown below:

$$\text{Return on asset (ROA)} = \frac{\text{Net income for past fiscal year}}{\text{Total asset at end of past fiscal year}}$$

4.5.2 Company competitive aggressiveness

Amount of asset disposal

Asset disposal is measured as the sum of the proceeds from the sale of investments, securities, businesses, plants and equipment.

Headcount reduction

Headcount reduction is defined as the number of employees terminated within each action year. The number is calculated as the drop in employees during the action year.

Action volume

Action volume is the total number of competitive actions carried out in an action year.

These actions were of the following nine types:

1. Dispose of assets and businesses
2. Reduce headcount
3. Change TMT and board of directors
4. Establish alliances, mergers and fund new ventures
5. Investing in facilities that support core customers
6. Finance company activities

7. Fight class lawsuits, SEC investigations
8. Number of product and technology trials
9. Number of new product introductions and new features on existing products

The number of competitive action events in each type is counted according to the date of company's announcements for starting taking the actions, not the date of closing off the actions.

Action diversity

Action diversity measures the degree to which a company undertakes a range of different action types. The basis of this measure is Herfindahl index, which is commonly used to measure the level of diversification (Ferrier, 2001; Ferrier, Smith, & Grimm, 1999). The formula is:

$$A=1-\sum_{i=1}^n (N_i/T_i)^2$$

Where N_i/T_i is the proportion of competitive actions in the i th action type; n is 9 for nine action types. Companies with high scores carry out competitive actions that typically consist of a broad range of action types; low score indicates that a company typically carries out competitive actions with just a few action types.

4.5.3 Company performance variables

Company performance was measured in three ways: sales per employee, one-year percentage change in sales, and return on assets.

Sales per employee

For an action year, sales per employee is calculated as:

$$\text{Sales per employee} = \frac{\text{Sales}}{\text{Number of employees at end of the fiscal year}}$$

A manager of one of the most successful telecommunications companies, who reviewed an earlier draft of the thesis, suggested that sales per employee is an important company performance measure during market meltdowns. A similar measurement, revenue per available seat mile, was used as a performance variable for the airline industry (Miller & Chen, 1994).

Change in sales

Following Boeker (1997), change in sales was calculated as:

$$\text{Change in sales} = \frac{\text{Sales in current year} - \text{Sales in previous one year}}{\text{Sales in previous one year}}$$

Return on assets

Following Yong et al. (1996), return on assets was calculated as:

$$\text{Return on assets} = \frac{\text{Gross profit}}{\text{Total assets}}$$

4.6 Data analysis

The first step of the data analysis was to calculate the descriptive statistics for each variable and determine whether or not they were normally distributed.

The second step was to calculate the correlation coefficients to determine associations between variables. Two tail tests were used to determine associations between variables, and one-tailed tests were used to determine directional associations. Spearman correlation coefficients were used because variables were not normally distributed.

The third step consisted in regressing all dimensions of competitive aggressiveness against the firm-level factors using the stepwise regression method. The formulation of the stepwise linear regression for each dimension of competitive aggressiveness was:

$$\begin{aligned}
Y_i = & b_0 + b_1 \times \text{TMT tenure diversity} \\
& + b_2 \times \text{TMT function diversity} \\
& + b_3 \times \text{TMT education diversity} \\
& + b_4 \times \text{Liquidity} + b_5 \times \text{Past performance}
\end{aligned}$$

Y_i is one of Asset disposal, Headcount reduction, Action volume, or Action diversity; b_0 is a constant; b_1 to b_5 are the coefficients of the firm-level factors.

The purpose of this step was to identify the firm-level factors that entered in the four stepwise regressions and the links between these factors and the dimensions of competitive aggressiveness. The results of these regressions were used to define a structural equation model.

I also used the stepwise procedure to regress the three company performance measures against the four dimensions of competitive aggressiveness. The results were used to test hypotheses 4-7.

The fourth step was to use AMOS to estimate the regression estimates of the structural equations in the model developed from the results of the stepwise regressions. Structural Equation Modeling (SEM) is an extension of the general linear model (GLM)

that enables a researcher to test a set of paths simultaneously.

The fifth step was comprised of making decisions on whether to accept or reject the hypotheses based on the AMOS results.

5 RESULTS

5.1 Sample

The sample is comprised of 71 company years drawn from 36 suppliers of telecommunications equipment.

All companies for which company year data was included in the sample are suppliers of telecommunications equipment, are listed in the NYSE, sell to public service providers and telecom carriers, and have readily available financial data and new releases for the January 2001 to October 2003 period. Their products cover fixed-line communication, wireless telecommunication, data communication, and telephone communication market segments.

A total of 442 companies were listed in the Yahoo! Finance directory under the path of: Industries > Communications Equipment > Company Index. Of these 442 companies, 216 were public companies. Of the 216 public companies, 41 sold directly to service providers. Of the 41 companies that sold to service providers, two had gone public during the study period (no data was available prior to going public), and three companies did not maintain their news releases in their websites. This left 36 companies from which to draw data. Table 4 provides these companies' names and the number of fiscal years they contributed to the sample.

Table 4. Companies in the sample, their fiscal years, and the number of fiscal years they contributed to the sample

	Company name	Fiscal year	Number of fiscal years in sample
1	Advanced Fiber Communications, Inc.	January 2001 – December 2002	2
2	AirNet Communications Corp.		2
3	AirSpan Networks Inc.		2
4	Alcatel		2
5	Avici Systems Inc.		2
6	CoSine Communication, Inc.		2
7	ECI Telecom Ltd.		2
8	Juniper Networks, Inc.		2
9	Motorola, Inc.		2
10	Nokia Corp.		2
11	Nortel Networks Corp.		2
12	Redback Networks Inc.		2
13	Tekelec		2
14	Telefonaktiebolaget LM Ericsson		2
15	Tellabs, Inc.		2
16	Sonus Networks, Inc.		2
17	ADTRAN, Inc.		2
18	Carrier Access Corp.		2
19	Copper Mountain Networks, Inc.		2
20	Foundry Networks, Inc.		2
21	NMS Communications Corp.	January 2002 – December 2002	1
22	Sorrento Networks Corp.	February 2001 – January 2003	2
23	Riverstone Networks, Inc	March 2001 – February 2003	2
24	Marconi Corp.	April 2001 – March 2003	2
25	NEC Corp.		2
26	Westell Technologies, Inc.		2
27	Stratex Network, Inc.	April 2001 – March 2003	2
28	Extreme Networks, Inc.	July 2001 – June 2003	2
29	Verlink Corp.		2

	Company name	Fiscal year	Number of fiscal years in sample
30	Globecom Systems Inc.	July 2001 – June 2003	2
31	InterWAVE Communications International Ltd.		2
32	Cisco Systems, Inc.	August 2001- July 2003	2
33	Sycamore Networks, Inc.		2
34	Lucent Technologies Inc.	October 2001– September 2003	2
35	CIENA Corp.	November 2001- October 2003	2
36	ADC Telecommunications, Inc.	November 2001- October 2003	2
	Total		71

5.2 Descriptive statistics

Table 5 provides the descriptive statistics for the 12 variables in the research model shown in Figure 1. The variables include TMT diversity, liquidity and past performance as firm-level variables. TMT diversity has three variants: TMT tenure diversity, TMT function diversity, and TMT education diversity. The variables also include four dimensions of competitive aggressiveness (Asset disposal, Headcount reduction, Action volume, Action diversity), and three measure of company performance (Sales per employee, Change in sales, and Return on assets).

Table 5. Descriptive Statistics
(Sample size = 71)

	Minimum	Maximum	Mean	Standard deviation	Skewness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
TMT tenure diversity	.000	1.126	.560	.284	.183	.291	-.552	.574
TMT function diversity	.444	.840	.702	.093	-.964	.291	.646	.574
TMT education diversity	.219	.720	.526	.121	-.437	.295	-.617	.582
Liquidity	.598	8.790	3.315	2.343	.787	.285	-.648	.563
Past performance	-4.753	.238	-.402	.774	-3.660	.285	16.743	.563
Asset disposal	.00	23531.00	1252.410	3869.254	5.419	.285	29.584	.563
Headcount reduction	-3800	41900	4343.61	9479.860	2.460	.285	5.429	.563
Action volume	2	239	47.06	54.411	1.860	.285	2.755	.563
Action diversity	.396	.844	.685	.104	-.971	.285	.496	.563
Sales per employee	2.26	722.92	260.962	138.384	1.001	.285	1.279	.563
Change in sales	-.920	2.542	-.140	.549	3.196	.285	13.063	.563
Return on assets	-.444	.582	.181	.187	-.494	.285	1.129	.563

Examination of the skewness and kurtosis statistics led me to conclude that three variables are normally distributed: TMT tenure diversity, TMT education diversity, and return on assets. For each of these three variables, skewness is within 2 times the standard

error of the skewness statistic and kurtosis is within -2 and $+2$. The other nine variables are not normally distributed.

5.3 Spearman correlation coefficients

Firm-level factors

Table 6 provides the Spearman correlation coefficients for the firm-level factors in the research model. Two tailed tests of the alternative hypothesis at $p < 0.01$ showed no associations. Two tailed tests at $p < 0.05$ showed the following associations:

- TMT tenure diversity is associated with TMT function diversity
- TMT tenure diversity is associated with Liquidity

At $p < .10$, the tests showed that TMT function diversity is associated with TMT education diversity.

Table 6. Spearman correlations for the firm-level factors in the research model
(Sample size N=71)

	TMT tenure diversity	TMT function diversity	TMT education diversity	Liquidity	Past performance
TMT tenure diversity	1.000				
TMT function diversity	.257 (.035**)	1.000			
TMT education diversity	.098 (.432)	.210 (.091*)	1.000		
Liquidity	-.275 (.023**)	-.135 (.272)	-.033 (.792)	1.000	
Past performance	.048 (.695)	.023 (.854)	.062 (.619)	.111 (.356)	1.000

* p < 0.10 (2-tailed)

** p < 0.05 (2-tailed)

*** p < 0.01 (2-tailed)

Table 7 provides the Spearman correlation coefficients for the four dimensions of competitive aggressiveness (Asset disposal, Headcount reduction, Action volume, and Action diversity). Two tailed tests of the alternative hypothesis at $p < 0.01$ show the following associations:

- Asset disposal is associated with Headcount reduction
- Asset disposal is associated with Action volume
- Headcount reduction is associated with Action volume

Table 7. Spearman correlations for the four dimensions of competitive aggressiveness
(Sample size = 71)

	Asset disposal	Headcount reduction	Action volume	Action diversity
Asset disposal	1.000 .			
Headcount reduction	.448 (.000***)	1.000 .		
Action volume	.565 (.000***)	.618 (.000***)	1.000 .	
Action diversity	-.152 (.205)	.139 (.248)	-.204 (.088*)	1.000 .

* p < 0.10 (2-tailed)

** p < 0.05 (2-tailed)

*** p < 0.01 (2-tailed)

Firm-level factors and dimensions of competitive aggressiveness

The first three hypotheses posit that TMT diversity, liquidity, and past performance are related to competitive aggressiveness.

Table 8 provides the Spearman correlation coefficients for the firm-level factors and the four dimensions of competitive aggressiveness.

Table 8. Spearman correlation coefficients between firm-level factors and the four dimensions of competitive aggressiveness
(Sample size = 71)

Firm-level factors	Competitive aggressiveness dimensions			
	Asset disposal	Headcount reduction	Action volume	Action diversity
TMT tenure diversity	-.058 (.320)	.188 (.062*)	.352 (.002***)	-.075 (.271)
TMT function diversity	.183 (.068*)	.363 (.001***)	.269 (.013**)	-.042 (.366)
TMT education diversity	.098 (.216)	.188 (.065*)	.099 (.214)	.140 (.131)
Liquidity	-.095 (.216)	-.501 (.000***)	-.505 (.000***)	.005 (.484)
Past performance	.390 (.000***)	.021 (.430)	.273 (.011**)	-.187 (.059*)

* p < 0.10 (1-tailed)

** p < 0.05 (1-tailed)

*** p < 0.01 (1-tailed)

One tailed tests of the alternative hypothesis at $p < 0.01$ show the following associations:

- TMT tenure diversity is positively associated with Action volume
- TMT function diversity is positively associated with Headcount reduction
- Liquidity is negatively associated with Headcount reduction and Action volume
- Past performance is positively associated with Asset disposal

One tailed tests of the alternative hypothesis at $p < 0.05$ show the following associations:

- TMT function diversity is positively associated with Action volume
- Past performance is positively associated with Action volume

One tailed tests of the alternative hypothesis at $p < 0.10$ show the following associations:

- TMT tenure diversity is positively associated with Headcount reduction
- TMT function diversity is positively associated with Asset disposal
- TMT education diversity is positively associated with Headcount reduction
- Past performance is negatively associated with Action diversity

Dimensions of competitive aggressiveness and company performance

Table 9 shows the Spearman correlation coefficients for the four dimensions of competitive aggressiveness and the three measures of company performance.

Table 9. Spearman correlation coefficients for competitive aggressiveness dimensions and company performance
(Sample size = 71)

Company performance	Competitive aggressiveness dimensions			
	Asset disposal	Headcount reduction	Action volume	Action diversity
Sales per employee	.193 (.053*)	-.146 (.112)	.124 (.151)	-.389 (.000***)
Change in sales	-.008 (.473)	-.355 (.001***)	.099 (.206)	-.283 (.008***)
Return on assets	-.009 (.469)	-.090 (.228)	.370 (.001***)	-.544 (.000***)

* $p < 0.10$ (1-tailed)

** $p < 0.05$ (1-tailed)

*** $p < 0.01$ (1-tailed)

One tailed tests of the alternative hypothesis at $p < 0.01$ show the following associations:

- Action diversity is negatively related with sales per employee, change in sales, and return on assets
- Headcount reduction is negatively related with change in sales
- Action volume is positively related with return on assets

5.4 Stepwise regressions

Dimensions of competitive aggressiveness as dependent variables

Each of the four dimensions of competitive aggressiveness was regressed against the three firm-level factors using stepwise regression. Tables 10a, b, and c show the results of the stepwise regressions. TMT education heterogeneity was entered by the stepwise procedure when Asset disposal was the dependent variable. Liquidity and past performance were entered when Headcount reduction and Action volume were the dependent variables. No firm-level factor was entered by the stepwise procedure when Action diversity was the dependent variable.

Table 10a shows that, at $p < 0.01$, the regression coefficient for TMT education diversity was negative and significant. Tables 10b and 10c show that the regression coefficients

for Liquidity were negative and the coefficients for Past performance were positive.

Table 10a. Stepwise regression with Asset disposal as the dependent variable and firm-level factors as the potential explanatory variables
(Sample size = 71)

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square
	B	Std. Error	Beta			
(Constant)	7115.290	2021.983		3.519	.001***	0.100
TMT education diversity	-11149.693	3755.033	-.337	-2.969	.004***	

* p < 0.10

** p < 0.05

*** p < 0.01

Table 10b. Stepwise regression with Headcount reduction as the dependent variable and firm-level factors as the potential explanatory variables
(Sample size = 71)

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square
	B	Std. Error	Beta			
(Constant)	11155.146	1968.047		5.668	.000***	0.171
Liquidity	-1748.150	448.660	-.432	-3.896	.000***	
Past performance	2528.698	1358.189	.206	1.862	.067*	

* p < 0.10

** p < 0.05

*** p < 0.01

Table 10c. Stepwise regression with Action volume as the dependent variable and firm-level factors as the potential explanatory variables
(Sample size = 71)

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square
	B	Std. Error	Beta			
(Constant)	95.155	10.564		9.008	.000***	0.275
Liquidity	-11.890	2.408	-.512	-4.937	.000***	
Past performance	21.606	7.290	.307	2.964	.004***	

* p < 0.10

** p < 0.05

*** p < 0.01

Company performance measures as dependent variables

Each of the three measures of company performance was regressed against the four dimensions of competitive aggressiveness using stepwise regression.

Table 11a provides the results of the stepwise regression with sales per employee as the dependent variable. The two included variables were Action diversity and Asset disposal. The regression coefficient for Action diversity was negative and significant with $p < 0.01$, and the regression coefficient for Asset disposal was positive and significant with $p < .10$.

Table 11a. Results of stepwise regression with sales per employee as the dependent variable and the four dimensions of competitive aggressiveness as the potential explanatory variables

Explanatory variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square
	B	Std. Error	Beta			
(Constant)	597.313	104.245		5.730	.000***	0.228
Action diversity	-505.495	148.115	-.381	-3.413	.001***	
Asset disposal	.008	.004	.219	1.962	.054*	

* p < 0.10

** p < 0.05

*** p < 0.01

Table 11b provides the results of the stepwise regression with change in sales as the dependent variable. One explanatory variable was included: action diversity. The regression coefficient for action diversity was negative with $p < 0.10$.

Table 11b. Results of stepwise regression with change in sales as the dependent variable and the four dimensions of competitive aggressiveness as the potential explanatory variables

Explanatory variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square
	B	Std. Error	Beta			
(Constant)	.670	.427		1.568	.121	0.037
Action diversity	-1.182	.617	-.225	-1.916	.059	

* p < 0.10

** p < 0.05

*** p < 0.01

The results of the stepwise regression with return on assets as the dependent variable are shown in Table 11c. Two explanatory variables were included: Action diversity and Action volume. The regression coefficient for action diversity is negative with $p < 0.01$, and the regression coefficient for action volume is positive with $p < 0.10$.

Table 11c. Results of stepwise regression with return on assets as the dependent variable and the four dimensions of competitive aggressiveness as the potential explanatory variables

Explanatory variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square
	B	Std. Error	Beta			
(Constant)	.703	.134		5.246	.000	0.257
Action diversity	-.811	.188	-.452	-4.319	.000***	
Action volume	.001	.000	.203	1.940	.057*	

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$

5.5 Structural equation models for each of the three dependent variables

For each of the three performance measures (sales per employee, change in sales, and gross profit as a percentage of assets), models that can be specified using the AMOS software were identified. Each model included:

- a performance measure as the dependent variable
- firm-level factors as exogenous variables
- four dimensions of competitive aggressiveness as endogenous variables
- specifications for the correlations among the firm-level factors
- specifications for the correlations among the endogenous factors
- specification that an unknown exogenous factor affected an endogenous variable

A model met the criteria of goodness of fit if its:

- Probability level for chi-square test was greater than 0.05
- Tucker-Lewis Indices (TLI) was 0.95 or higher
- Root Mean Square Errors of Approximations (RMSEA) was 0.06 or less

Sales per employee

Model 1

Based on the results shown in Tables 10a, 10b and 10c, I specified the following paths between firm-level factors and dimensions of competitive aggressiveness which were then entered to the AMOS software:

TMT education heterogeneity → Asset disposal

Liquidity → Headcount reduction

Liquidity → Action volume

Past performance → Headcount reduction

Past performance → Action volume

Table 6 shows that TMT education heterogeneity, Liquidity and Past performance were not correlated. Thus, I did not specify correlation links in the AMOS software.

I also added the following four paths to capture the competitive aggressiveness-company performance relationship:

Asset disposal → Sales per employee

Headcount reduction → Sales per employee

Action volume → Sales per employee

Action diversity → Sales per employee

Given that none of the firm-level factors had a path that pointed to Action diversity, I specified in the AMOS software that Action diversity was a function of an unknown exogenous variable.

Table 7 indicates that Asset disposal, Headcount reduction and Action volume are correlated among themselves and the Action diversity and Action volume are also correlated. Accordingly, I specified the correlation relationships in the AMOS software.

Table 12 shows the results obtained from applying AMOS to model 1 defined above.

**Table 12. Results of using AMOS to obtain regression estimates for Model 1:
sales per employee**

Model 1		Regression	p
Paths		estimate	
Chi-square = 27.63	TMT education diversity → Asset disposal	-.338	.001***
Degrees of freedom = 15	Liquidity → Headcount reduction	-.416	.000***
Probability level = .024	Liquidity → Action volume	-.466	.000***
TLI = .725	Past performance → Headcount reduction	.193	.068*
RMSEA = 0.110	Past performance → Action volume	.264	.004***
Squared multiple correlations	Asset disposal → Sales per employee	.146	.188
Sales per employee = .25	Headcount reduction → Sales per employee	-.292	.046**
Asset disposal = .11	Action volume → Sales per employee	.317	.040**
Headcount reduction = .21	Action diversity → Sales per employee	-.334	.002***
Action volume = .28			
Action diversity = .00			

* p < 0.10

** p < 0.05

*** p < 0.01

The results suggest that the model does not fit the data well. The Probability level of model 1 is less than .05, the TLI is less than .95, and the RMSEA is less than .95.

A rule of thumb is that 15 variables are needed per each variable included in an AMOS model. Given that model 1 includes 8 variables this would mean that I would need a sample size of 120.

Model 2

To examine whether or not the fit of the model could be improved, I eliminated the link that had the highest p. Table 12 shows that the highest p corresponded to the Asset disposal → Sales per employee link. Therefore, Model 2 was specified as follows:

Liquidity → Headcount reduction

Liquidity → Action volume

Past performance → Headcount reduction

Past performance → Action volume

Headcount reduction → Sales per employee

Action volume → Sales per employee

Action diversity → Sales per employee

The model 2 specified in the AMOS software indicated that Action diversity was a function of an unknown exogenous variable and that Headcount reduction was correlated with Action volume and Action diversity, and that Action diversity was correlated with Action volume.

Table 13 shows the results obtained from using AMOS to estimate the parameters of model 2. While the goodness of fit statistics for model 2 were better than those for model 1, they still did not meet my criteria. I continued to suspect that the reason for the poor fit was due to the fact that too many variables were included in model 2.

**Table 13. Results of using AMOS to obtain regression estimates for Model 2:
sales per employee**

Model 2		Regression	p
Paths		estimate	
Chi-square = 10.39 Degrees of freedom = 6 Probability level = .109 TLI = .883 RMSEA = 0.102	Liquidity → Headcount reduction	-.425	.000***
	Liquidity → Action volume	-.494	.000***
	Past performance → Headcount reduction	.203	.054*
	Past performance → Action volume	.297	.002***
	Headcount reduction → Sales per employee	-.313	.029*
Squared multiple correlations Sales per employee = .28 Headcount reduction = .22 Action volume = .33 Action diversity = .00	Action volume → Sales per employee	.400	.007***
	Action diversity → Sales per employee	-.356	.000***

* p < 0.10

** p < 0.05

*** p < 0.01

Model 3

I noted that Past performance → Headcount link had the highest p and that the two lowest standardized estimates were associated with Past performance. Therefore, I decided to eliminate the two paths that included Past performance and specify model 3 as follows:

Liquidity → Headcount reduction

Liquidity → Action volume

Headcount reduction → Sales per employee

Action volume → Sales per employee

Action diversity → Sales per employee

Table 14 shows the results of using AMOS to estimate the parameters of model 3.

**Table 14. Results of using AMOS to obtain regression estimates for Model 3:
sales per employee**

Model 3		Regression	p
Paths		estimate	
Chi-square = .873	Liquidity → Headcount reduction	-.392	.000***
Degrees of freedom = 3	Liquidity → Action volume	-.449	.000***
Probability level = .832	Headcount reduction → Sales per employee	-.308	.029**
TLI = 1.089	Action volume → Sales per employee	.389	.008***
RMSEA = 0.000	Action diversity → Sales per employee	-.356	.000***
Squared multiple correlations			
Sales per employee = .28			
Headcount reduction = .15			
Action volume = .20			
Action diversity = .00			

* p < 0.10

** p < 0.05

*** p < 0.01

The goodness of fit statistics for model 3 is better than those obtained for models 1 and 2.

For model 3, the probability level was greater than .05, the TLI was greater than .95 and the RMSEA was lower than 0.06.

Change in sales

Model 4 specified a relationship between firm-level factors and competitive aggressiveness that was identical to that specified for model 1. The competitive aggressiveness-company performance relationship included change in sales as the dependent variable instead of sale per employee. This relationship was defined as:

Asset disposal → Change in sales

Headcount reduction → Change in sales

Action volume → Change in sales

Action diversity → Change in sales

Table 15 shows the parameters of model 4 obtained from AMOS.

**Table 15. Results of using AMOS to obtain regression estimates for Model 4:
Change in sales**

Model 4		Regression	p
Paths		estimate	
Chi-square = 20.82	TMT education diversity → Asset disposal	-.338	.001***
Degrees of freedom = 15	Liquidity → Headcount reduction	-.416	.000***
Probability level = .143	Liquidity → Action volume	-.466	.000***
TLI = .834	Past performance → Headcount reduction	.193	.068*
RMSEA = 0.074	Past performance → Action volume	.264	.004***
Squared multiple correlations	Asset disposal → Change in sales	-.108	.378
Change in sales = .08	Headcount reduction → Change in sales	-.163	.315
Asset disposal = .11	Action volume → Change in sales	.092	.592
Headcount reduction = .21	Action diversity → Change in sales	-.227	.054*
Action volume = .28			
Action diversity = .00			

* p < 0.10

** p < 0.05

*** p < 0.01

The probability level was greater than .05, but the TLI was less than 0.95, and the RMSEA was higher than .06. I concluded that the goodness of fit for model 4 was not a good one. Moreover, the squared multiple correlation for Change in sales was only .08.

This meant that the four dimensions of competitive aggressiveness were unable to explain the variations of the dependent variable, change in sales. I concluded that further analysis was not warranted.

Return on assets

Model 5 specified a relationship between firm-level factors and competitive aggressiveness that was identical to that specified for models 1 and 4. The competitive aggressiveness-company performance relationship included return on assets as the dependent variable. This relationship was defined as:

Asset disposal → Return on assets

Headcount reduction → Return on assets

Action volume → Return on assets

Action diversity → Return on assets

Table 16 shows the parameters of model 5 obtained from AMOS.

**Table 16. Results of using AMOS to obtain regression estimates for Model 5:
Return on assets**

Model 5		Regression	p
Paths		estimate	
Chi-square = 22.83	TMT education diversity → Asset disposal	-.338	.001***
Degrees of freedom = 15	Liquidity → Headcount reduction	-.416	.000***
Probability level = .088	Liquidity → Action volume	-.466	.000***
TLI = .828	Past performance → Headcount reduction	.193	.068*
RMSEA = 0.086	Past performance → Action volume	.264	.004***
Squared multiple correlations	Asset disposal → Return on assets	-.179	.083*
Return on assets = .34	Headcount reduction → Return on assets	-.227	.097*
Asset disposal = .11	Action volume → Return on assets	.419	.004***
Headcount reduction = .21	Action diversity → Return on assets	-.442	.000***
Action volume = .28			
Action diversity = .00			

* p < 0.10

** p < 0.05

*** p < 0.01

The goodness of fit statistics for model 5 were better than those for model 1 and much better than those for model 4. However, the probability level, TLI and RMSEA for model 5 did not meet the criteria set for this research.

Model 6

The two links in model 5 with the highest p values were: Asset disposal → Return on assets and Headcount reduction → Return on assets. Removal of the Asset disposal → Return on assets link removes two variables from the model: Asset disposal and TMT

education heterogeneity. The removal of Headcount reduction → Return on assets results in the removal of one variable: Headcount reduction. To improve the goodness of fit of the model I decided to remove the Asset disposal → Return on assets link.

Model 6 was specified as follows:

Liquidity → Headcount reduction

Liquidity → Action volume

Past performance → Headcount reduction

Past performance → Action volume

Headcount reduction → Return on assets

Action volume → Return on assets

Action diversity → Return on assets

In addition I specified that Headcount reduction and action volume were correlated, that Action volume and Action diversity were correlated, and that Action diversity was explained by an unknown variable.

Table 17 includes the parameters of model 6 as obtained from AMOS.

**Table 17. Results of using AMOS to obtain regression estimates for Model 6:
Return on assets**

Model 6		Regression	p
Paths		estimate	
Chi-square = 5.925	Liquidity → Headcount reduction	-.425	.000***
Degrees of freedom = 6	Liquidity → Action volume	-.494	.000***
Probability level = .432	Past performance → Headcount reduction	.203	.054*
TLI = 1.002	Past performance → Action volume	.297	.002***
RMSEA = 0.000	Headcount reduction → Return on assets	-.195	.169
Squared multiple correlations	Action volume → Return on assets	.353	.015**
Return on assets = .30	Action diversity → Return on assets	-.407	.000***
Headcount reduction = .22			
Action volume = .33			
Action diversity = .00			

* p < 0.10

** p < 0.05

*** p < 0.01

The goodness of fit statistics for model 6 meets my criteria. The probability level of .432 is greater than .05; TLI of 1.002 is greater than 0.95, and RMSEA of 0.0 is lower than 0.06.

5.6 Summary of the results organized by hypothesis

Table 18 provides the results of testing the hypotheses using the stepwise regressions results shown in Tables 10a, b, and c and Tables 11a, 11b and 11c as well as the parameters of models shown in Tables 12-17.

A hypothesis was supported when all regression estimates in stepwise and/or SEM models were significant at $p < .10$ and were in the same direction as expected.

A hypothesis was not supported when:

- regression estimates in stepwise and/or SEM models were significant at $p < .10$ and in the opposite direction as expected
- regression estimates in stepwise and/or SEM models were not significant at $p < .10$

Results were deemed inconclusive when:

- some regression estimates from stepwise and/or SEM models were significant at $p < .10$, others were either not significant or significant in opposite directions

Table 18. Summary of test results organized by hypothesis

Hypothesis	Decision based on test results	Rationale
Hypothesis 1at TMT tenure diversity is negatively related to asset disposal.	Not supported	TMT tenure diversity did not enter the stepwise regression in Table 10a.
Hypothesis 1bt TMT tenure diversity is negatively related to headcount reduction.	Not supported	TMT tenure diversity did not enter the stepwise regression in Table 10b.
Hypothesis 1ct TMT tenure diversity is negatively related to action volume.	Not supported	TMT tenure diversity did not enter the stepwise regression in Table 10c.
Hypothesis 1dt TMT tenure diversity is positively related to action diversity.	Not supported	TMT tenure diversity did not enter the stepwise regression with action diversity as a dependent variable.
Hypothesis 1af TMT function diversity is negatively related to asset disposal.	Not supported	TMT function diversity did not enter the stepwise regression in Table 10a.
Hypothesis 1bf TMT function diversity is negatively related to headcount reduction.	Not supported	TMT function diversity did not enter the stepwise regression in Table 10b.
Hypothesis 1cf TMT function diversity is negatively related to action volume.	Not supported	TMT tenure diversity did not enter the stepwise regression in Table 10c.
Hypothesis 1df TMT function diversity is positively related to action diversity.	Not supported	TMT function diversity did not enter the stepwise regression with action diversity as a dependent variable.

Hypothesis	Decision based on test results	Rationale
Hypothesis 1ae TMT education diversity is negatively related to asset disposal.	Supported	Regression coefficient in stepwise regression results shown in Table 10a is negative and significant at $p < 0.01$; Regression estimates in Models 1, 4 and 5 in Tables 12, 15 and 16 are negative and significant at $p < 0.01$
Hypothesis 1be TMT education diversity is negatively related to headcount reduction.	Not supported	TMT education diversity did not enter the stepwise regression in Table 10b.
Hypothesis 1ce TMT education diversity is negatively related to action volume.	Not supported	TMT education diversity did not enter the stepwise regression in Table 10c
Hypothesis 1de TMT education diversity is positively related to action diversity.	Not supported	TMT education diversity did not enter the stepwise regression with action diversity as a dependent variable.
Hypothesis 2a High level of liquidity is negatively related to asset disposal.	Not supported	Liquidity did not enter the stepwise regression in Table 10a.
Hypothesis 2b High level of liquidity is negatively related to headcount reduction.	Supported	Regression coefficient in stepwise regression results shown in Table 10b is negative and significant at $p < 0.01$; Regression estimates in models 3, 6 and in Tables 14, 17 are negative and significant at $p < 0.01$.

Hypothesis	Decision based on test results	Rationale
Hypothesis 2c High level of liquidity is positively related to action volume.	Not supported, significant relationship in the opposite direction	Regression coefficient in stepwise regression results shown in Table 10c is negative and significant at $p < 0.01$; Regression estimates in models 3, 6 and in Tables 14, 17 are negative and significant at $p < 0.01$.
Hypothesis 2d High level of liquidity is positively related to action diversity.	Not supported	Liquidity did not enter the stepwise regression with action diversity as a dependent variable.
Hypothesis 3a Good past performance is negatively related to asset disposal.	Not supported	Past performance did not enter the stepwise regression in Table 10a.
Hypothesis 3b Good past performance is negatively related to headcount reduction.	Not supported, significant relationship in the opposite direction	Regression coefficient in stepwise regression results shown in Table 10b is positive and significant at $p < 0.10$; Regression estimate in model 6 in Table 17 is positive and significant at $p < 0.10$.
Hypothesis 3c Good past performance is negatively related to action volume.	Not supported, significant in the wrong direction	Regression coefficient in stepwise regression results shown in Table 10c is positive and significant at $p < 0.01$; Regression estimate in model 6 in Table 17 is positive and significant at $p < 0.01$.
Hypothesis 3d Good past performance is negatively related to action diversity.	Not supported	Past performance did not enter the stepwise regression with action diversity as a dependent variable.

Hypothesis	Decision based on test results	Rationale
Hypothesis 4a Asset disposal is positively related to sales per employee.	Inconclusive	Regression coefficient in stepwise regression results shown in Table 11a is positive and significant at $p < 0.10$; regression estimate in model 1 in Table 12 is not significant at $p < 0.10$.
Hypothesis 4b Asset disposal is positively related to change in sales.	Not supported	Asset disposal did not enter the stepwise regression with change in sales as the dependent variable in Table 11b.
Hypothesis 4c Asset disposal is positively related to return on assets	Not supported	Asset disposal did not enter the stepwise regression with return on assets as the dependent variable in Table 11c; regression estimate for Asset disposal in model 5 in Table 16 was negative and significant at $p < 0.10$.
Hypothesis 5a Headcount reduction is positively related to sales per employee.	Not supported, significant in the wrong direction	Headcount reduction did not enter the stepwise regression with sales per employee as the dependent variable in Table 11a; regression estimate for Headcount reduction in model 3 in Table 14 was negative at $p < 0.05$.
Hypothesis 5b Headcount reduction is positively related to change in sales.	Not supported	Headcount reduction did not enter the stepwise regression with change in sales as the dependent variable in Table 11b; regression estimate for Headcount reduction in model 4 in Table 15 was not significant.

Hypothesis	Decision based on test results	Rationale
Hypothesis 5c Headcount reduction is positively related to return on assets.	Not supported	Headcount reduction did not enter the stepwise regression with return on assets as the dependent variable in Table 11c; regression estimate for Headcount reduction in model 6 in Table 17 was not significant.
Hypothesis 6a Action volume is positively related to sales per employee.	Inconclusive	Action volume did not enter the stepwise regression with sales per employee as the dependent variable in Table 11a; regression estimate for Volume in model 3 in Table 14 is positive and significant at $p < .01$.
Hypothesis 6b Action volume is positively related to change in sales.	Not supported	Action volume did not enter the stepwise regression with change in sales as the dependent variable in Table 11b; regression estimates in model 4 in Table 15 is not significant at $p < .10$.
Hypothesis 6c Action volume is positively related to return on assets.	Supported	Regression coefficient in stepwise regression results shown in Table 11c is positive and significant at $p < .10$; regression estimates in model 6 in Table 17 is positive and significant at $p < .05$.
Hypothesis 7a Action diversity is negatively related to sales per employee.	Supported	Regression coefficient in stepwise regression results shown in Table 11a is negative and significant at $p < .01$; regression estimates in model 3 in Table 14 is negative and significant at $p < .01$.

Hypothesis	Decision based on test results	Rationale
Hypothesis 7b Action diversity is negatively related to change in sales.	Supported	Regression coefficient in stepwise regression results shown in Table 11b is negative and significant at $p < 0.10$; regression estimate in model 4 in Table 15 is negative and significant at $p < 0.10$.
Hypothesis 7c Action diversity is negatively related to return on assets.	Supported	Regression coefficient in stepwise regression results shown in Table 11c is negative and significant at $p < 0.01$; regression estimate in model 6 in Table 17 is negative and significant at $p < 0.01$.

6 DISCUSSION OF RESULTS

The objective of this thesis was to examine the relationship between telecommunications equipment suppliers' competitive actions and company performance during the 2001-2003 market meltdown.

A research model and seven sets of hypotheses based on Ferrier's competitive aggressiveness framework (Ferrier 2001) were developed. The hypotheses were tested using the AMOS implementation of Structural Equation Modeling and stepwise regression analyses. The sample included 71 company years drawn from the 2001-2003 period.

6.1 Firm-level factors that affect competitive aggressiveness during market meltdowns

TMT diversity

The first set of hypotheses tested the relationship between three variants of TMT diversity and competitive aggressiveness. My results suggest that during a market meltdown:

1. TMT education diversity affects asset disposal and not the other three dimensions of competitive aggressiveness.
2. TMT tenure diversity and TMT function diversity do not affect competitive aggressiveness during market meltdowns.

I should expect that the greater the TMT's education diversity, the smaller the amounts of assets the company will divest itself during a market meltdown. TMT education diversity was the only variable entered by the stepwise regression procedure when asset disposal was the dependent variable and the three dimensions of firm-level factors were the potential explanatory variables. The standardized coefficient was -.337 and significant at $p < .01$. The regression estimates for when TMT education diversity is regressed against Asset disposal are -.338 in models 1 (Table 12), 4 (Table 15), and 5 (Table 16) and significant at $p < .01$.

The first finding identified above is consistent with previous research (Hambrick, Cho, & Chen, 1996; Knight et al., 1999). TMT diversity affects the dimensions of competitive aggressiveness in different ways.

The second finding identified above differs from the results reported in Hambrick et al. (1996) and Ferrier (2001). My results suggest that TMT diversity does not affect company aggressiveness in the same way as it does during market growth period.

Liquidity

The second set of hypotheses examined in this research posited that liquidity was negatively related to asset disposal and headcount reduction, and positively related to action volume and action diversity. The set of hypotheses built on the research published to date (Ferrier 2001). My results suggest that during a market meltdown:

- High liquidity is negatively related to headcount reduction
- High liquidity is negatively related to action volume
- Liquidity does not affect asset disposal or action diversity

The first finding listed above supports hypothesis 2b. I expected that high levels of liquidity would result in the termination of fewer employees during market meltdown conditions.

The second finding listed above is contrary to what I expected to find. Based on the results from previous research studies (Ferrier, 2001), high-level liquidity provides the capability to undertake a large number of actions and implement actions faster. I worded hypothesis 2c expecting liquidity to be positively related with action volume. The findings suggest that during a market meltdown companies slow down their undertaking of new actions. This explanation is also suggested in (Smith, Grimm, Gannon, & Chen,

1991). Smith et al. (1991) explain it from the perspective of response likelihood affected by liquidity level. A company with high level of liquidity may consider it as a buffer between the company and environmental changes and thus senses less pressure or need to respond to environmental changes.

I did not find a strong relationship between liquidity and action diversity. This result is different from results published in Ferrier (2001). Moreover, I did not find a relationship between liquidity and asset disposal. Once again, this suggests that during a market meltdown, firm-level factors affect competitive aggressiveness in different ways that in growth or stable periods.

Past performance

The third set of hypotheses examined the relationship between past performance and competitive aggressiveness. My results suggest that during market meltdowns:

1. Good past performance is positively related to headcount reduction
2. Good past performance is positively related to action volume
3. Good past performance is not related to asset disposal or action diversity

The first two findings are contrary to what I expected. Based on findings in the literature (Ferrier, 2001; Hambrick, Geletkancz, & Fredrickson, 1993; Miller & Chen,

1994), I expected good past performance to be negatively related to headcount reduction and action volume. The results suggest that companies that performed well in the past terminate more employees and undertake more competitive actions than companies that did not perform well in the past. The results suggest that past performance affects competitive aggressiveness during a market meltdown in a different way from when the market is growing or stable. Lant, Milliken, and Batra (1992) argue that in a stable or growth market environments, good past performance may be a valid indicator of the effectiveness of a company's strategic orientation. Thus, good past performance causes a company to make less changes and actions. However, in a market meltdown top managers cannot rely on the current strategic orientation even though current orientation had good past performance.

These findings provide more evidence that the relationship between firm-level factors and competitive aggressiveness during market meltdowns is different from that which exists when the market is stable or growing. The three firm-level factors do not influence all dimensions of competitive aggressiveness. It is possible that other firm level factors may affect the dimensions of competitive aggressiveness during market meltdowns.

6.2 Dimensions of competitive aggressiveness that affect company performance during market meltdowns

The results of this research suggest a strong relationship between three dimensions of competitive aggressiveness (headcount reduction, action volume and action diversity) and company performance when measured as sales per employee and return on assets and very weak relationship when measured as increase in sales.

Asset disposal

My results are inconclusive as to whether or not asset disposal affects sales per employee and return on assets. Moreover, I found that asset disposal does not affect change in sales.

Asset disposal is one of two explanatory variables that were entered when the stepwise procedure was applied to the regression with sales per employee as the dependent variable and the four dimensions of competitive aggressiveness as potential explanatory variables. The coefficient was .219 and significant at $p < .10$. However, in model 1 shown in Table 12 the regression estimate for asset disposal was not significant at $p < .10$.

Asset disposal did not enter as an explanatory variable in the stepwise procedure applied to the regression with return on assets as the dependent variable and the four dimensions of competitive aggressiveness as the potential exploratory variables. However, in model 5

shown in Table 16, the regression estimate for asset disposal was negative and significant at $p < .10$.

Asset disposal did not enter as an explanatory variable in the stepwise procedure applied to the regression with increase in sales as the dependent variable and the four dimensions of competitive aggressiveness as the potential exploratory variables.

I conclude that it is not clear whether or not asset disposal is an effective way to increase company performance in the short-term.

Headcount reduction

Test results suggest that headcount reduction does not affect company performance in the short run. I did not find strong relationships between headcount reduction and the three measures of company performance used in this study.

Hambrick & Schechter (1983) found that asset divesting and cost cutting actions including headcount reduction were beneficial to companies under downturn in mature industries. In this research, telecommunication industry is a high tech industry associated with technology newness. Asset disposal and headcount reduction may not have the same impact in short-term in telecom industry as that in mature industries.

Action volume

My results suggest that action volume increases company performance when performance is measured as return on assets. This suggests that action volume is an effective tool to increase company performance and it is consistent with previous research (Ferrier, 2001; Yong, Smith, & Grimm, 1996).

My results were inconclusive as to whether or not action volume affects sales per employee. While the regression estimate for Volume in model 3 in Table 14 is positive and significant at $p < .01$, Volume was not entered as an explanatory variable by the stepwise procedures applied to the regression with sales per employee as the dependent variable and the four dimensions of competitive aggressiveness as the potential explanatory variables.

I did not find that action volume affects increases in sales. This suggests that the impact of action volume on sales increase is different during market meltdown from growth period.

Action diversity

I find that during a market meltdown, action diversity affects company performance more than any other dimensions of competitive aggressiveness. The more different types of actions a company undertakes during a market meltdown, the lower the company's sales

per employee and return on assets. This suggests that companies should focus on a narrow range of effective actions to improve company performance during market meltdowns.

6.3 Key findings

Three measures of company performance were used in this study. Figure 3 illustrates the results obtained using SEM and stepwise regression analyses. The full arrows illustrate the hypotheses that were supported. The broken arrows illustrate the hypotheses that were not supported because the relationship is opposite to what was expected. The dotted lines show the hypotheses for which tests are inconclusive.

Figure 3. Results of testing hypotheses

The key findings of this research are that during a period of market meltdown

- The greater action diversity, the lower company performance. Action diversity is the only dimension of responsive aggressiveness that affects all three measures of company performance.
- Action diversity and action volume affect company performance more than asset disposal and headcount reduction do
- Liquidity and to a lesser extent past performance affect competitive aggressiveness more than TMT diversity does. While TMT education diversity was found to affect asset disposal, a strong relationship between asset disposal and company performance was not established
- Traditional firm-level factors (TMT diversity, liquidity, and past performance) were found not to affect action diversity
- When sales per employee and return on assets are used as the company performance measure, headcount reduction, action volume and action diversity affect company performance, and liquidity affects both headcount reduction and action volume. When return on assets is used as the performance measure, past performance also affects action volume and headcount reduction
- When change in sales is used as the company performance measure, only action diversity affects company performance.

- The relationship between firm-level factors and competitive aggressiveness may be different for market downturns than it is for growth periods. Specifically, the relationships between liquidity and past performance with competitive aggressiveness seem to be different than those reported in the literature.

7 CONCLUSIONS, LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

7.1 Conclusions

The results of this research suggest that the relationship between action aggressiveness and company performance may be different during market meltdowns than that which exists during periods of growth.

It is clear that, during the market meltdown period studied,

- action diversity and action volume affected company performance
- liquidity constrains action volume

Firm-level factors other than those studied to date may affect competitive aggressiveness during meltdowns.

Previous researchers concluded that a TMT with high diversity was beneficial to a company during growth and turbulent environments. The results of this study suggest that the TMT's education affects asset disposal during meltdowns. However, asset disposal may not be an effective tool to improve company performance in the short term. I find that the greater the education diversity, the smaller the dollar amount of the assets a company

disposes off.

The strong relationship between action diversity and company performance found in this study suggests that during a market meltdown a company can perform better by refocusing its activities on core business. During market meltdown periods, limiting action types to a narrow range allows a company to concentrate on its core business and more quickly to improve its short-term performance.

7.2 Limitations of the research

The first limitation is the research only studied telecommunication companies. The sample does not cover other industries.

The second limitation is the research studied only one period of market meltdown since the data for other periods are not available on web sites.

The third limitation is all companies studied are public companies. It is not known whether private companies and public companies compete in different ways.

7.3 Suggestions for future research

The thesis opens interesting opportunities for researchers.

First, researchers need to identify the firm-level and external factors that affect company aggressiveness during market meltdowns, particularly action diversity. While action diversity was found to be the most important dimension of competitive aggressiveness affecting company performance, the three firm level factors did not strongly influence action diversity. I propose the following research question: What company- and external level factors influence action diversity during market meltdowns?

Second, researchers can test how asset disposal and headcount reduction affect company performance over a longer time period. This research found that asset disposal and headcount reduction did not improve company performance during one action year. However, it is not known how they impact company performance in longer term (i.e., two- or three-years later). I propose the following research question: How do asset disposal and headcount reduction during a market meltdown affect company performance over the near-, mid- and long-term?

Third, researchers can first develop a model that captures the salient relationships for growth periods and another one for meltdown periods, and then identify the differences

between the two models.

Fourth, researchers can examine whether a model that captures the relationship between the dimensions of competitive aggressiveness and company performance for the telecommunications industry is stable across industries.

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