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What Drives Merger Decision Making Behavior? Don't Seek, Don't Find, and Don't Change Your Mind

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Abstract

Despite the constant and frequent merger activity across various industries in the U.S. and throughout the world, limited evidence of the success of corporate mergers has been documented. The vast body of academic research demonstrates that most mergers add no value or reduce shareholder value for the acquiring firm. Furthermore, the traditional merger theories have not found significant empirical support. In the past twenty years, more behavioral explanations have been utilized to provide a theoretical basis for merger activity. The “hubris hypothesis” (Roll, 1986) was one of the first non-rational motivations offered to explain corporate merger activity. More recently, overconfidence and optimism have come to the forefront as the most common behavioral explanations for the continued prevalence of ill-advised mergers. This paper suggests that a different type of behavioral bias may also influence merger and acquisition decisions - confirmation bias. Using a unique experimental data set, we provide evidence in support of the existence of confirmation bias in merger decision making behavior. (JEL: G340)

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1 Introduction

In regard to corporate mergers, repeated analyses by academics, management consultants, and investment bankers have reached the same conclusion. In the short-term to medium-term, fewer than half of all mergers add value.¹ Additionally, one study reported that less than 30% of companies found that their M&A transactions achieved their stated objective within the planned time frame.² The shareholders whose company is bought end up richer, while the shareholders of the buyer seldom do. Although merging is not always a mistake, it is quite risky. Historically, merger activity has been difficult to rationalize in terms of traditional finance theory. However, in the past twenty years, more behavioral explanations have been utilized to provide a theoretical basis for merger activity. Roll (1986) was first to propose a non-rational motivation for corporate merger activity with the “hubris hypothesis.” More recently, overconfidence and optimism have come to the forefront as the most common behavioral explanations for the continued prevalence of ill-advised mergers (Malmendier & Tate, 2005). “Excessively optimistic and overconfident executives press on with an acquisition, even when the reaction in financial markets is negative.”³ However, this paper presents evidence of a different type of behavioral bias that may also influence merger and acquisition decisions - confirmation bias. Using experimental methods, this paper examines merger and acquisition decision making behavior and provides evidence in support of the presence of confirmation bias.

The existence of a confirmation bias in the merger and acquisition decision making process could have implications for developing CEO compensation plans. Typically these executive compensation plans are designed to tie compensation with firm performance for the purpose of eliminating agency problems. However, evidence of a behavioral bias that would interfere with an executive’s ability to properly evaluate investment opportunities may or may not be adequately addressed with current compensation schemes. As demonstrated by Bolton, Scheinkman, and Xiong (2006) and others, the explanations for the level and structure of CEO compensation have significant policy implications.

¹Economist (1999)

²*Solving the Merger Mystery: Maximizing the Payoff of Mergers and Acquisitions*: Deloitte Consulting (2000)

³Shefrin (2006), p. 162.

Correspondingly, the type of biases and behaviors that affect executive decision making should influence the design of compensation plans. The existence of these biases may also have significant implications for the enforcement of the *Sarbanes-Oxley Act of 2002* which is used to hold executives accountable for corporate malfeasance.

1.1 Determinants of Corporate Merger Activity

1.1.1 Traditional Theory

Financial theory tells us that the value of any asset is equal to the present value of its cash flows. In that context, a publicly held firm is merely a bundle of cash flows expected to be received in the future. Under the standard assumption that investors diversify to hold the market portfolio, merger activity does not necessarily add shareholder value. Mergers simply combine the rights to cash flows that are already held by diversified investors; investors who should be indifferent between receiving future cash flow streams from two separate firms or from one merged firm formed by combining them. Nonetheless, several major, non-mutually exclusive reasons are typically offered to explain merger activity (Bower, 2001; Warshawsky, 1987): limit competition and/or gain market share; extend product line; expand geographically; wrest corporate control from entrenched, inefficient management in order to realize greater profitability; gain tax advantages; exploit inefficiencies in the financial markets that leave corporate equities undervalued relative to their *intrinsic* worth.

In terms of a more rigorous theoretical basis for merger activity, there are a number of diverse theories. We know that modern finance theory is predicated on several assumptions that hold only as approximations in financial markets. Transaction costs, agency costs, informational asymmetries, taxation, and government regulation are all assumed away in most financial models. The presence of these and other market frictions could create situations in which mergers theoretically have the potential to create shareholder value. These theoretical explanations can be grouped into five major categories: microeconomics, financial distress, capital markets, taxation, economic shocks.

Microeconomics - Industrial organization theory offers the most straight-forward explanation. Simply put, mergers allow firms to acquire varying degrees of monopoly power, permitting them to increase cash flows by raising prices. In terms of production theory, there are several mechanisms through which a merger could increase shareholder value. Mergers could add value by generating economies of scale, economies of scope, or efficiency gains.

Financial Distress - Incorporating the cost of financial distress into financial theory also generates an additional rationalization for merger activity. In actual financial markets, especially in industries like financial services with stringent solvency regulation, firms face significant financial distress costs. Firms that are excessively leveraged or in a weak financial condition, incur higher regulatory costs and potential operating restrictions (Cummins & Weiss, 2004). In the 1970s, Lewellen (1971) advanced the *co-insurance* idea that the joining together of two firms whose earnings streams were less-than-perfectly correlated would reduce the risk of default of the merged firm and thereby increase the “debt capacity” or “borrowing ability” of the combined company. Thus, the increased total borrowing capacity of the resulting firm provided an economic incentive for shareholder-wealth-maximizing firms to engage in a merger. Lewellen’s thesis did not carefully examine the impact of the co-insurance effect on the value of the merging firm’s already outstanding debt. However, Kim and McConnell (1977) did find evidence that was consistent with the argument that a co-insurance effect did exist and that the wealth transfers to bondholders that would have been generated were negated by the increased use of debt financing.

Capital Markets - Inefficient capital markets is another theory offered to explain merger activity. In the 1980s, Lang, Stulz, and Walking (1989) found that the abnormal returns in tender offers⁴ are related to the Tobin’s q ratios (*ratio of market value of a firm to replacement cost*) of the targets and the bidders. They found that target, bidder, and total returns are higher when takeover targets have high q ratios and bidders have low q ratios. Servaes (1991) analyzed over 700 merger and tender offers between 1972 and 1987 to confirm the results of the work by Lang et al. and to show that their

⁴Public offer to purchase stock at a specified price per share. The bid price is generally at a price above the market price and is usually done to gain a controlling interest in a corporation.

findings also hold for mergers and hold after controlling for other determinants of takeover gains. Jovanovic and Rousseau (2002) use the Q-Theory of mergers to argue that mergers are a channel through which capital flows to better projects and better management. Informational asymmetries between managers and capital markets tend to make capital markets inefficient in allocating capital among alternative uses and thus may lead to higher costs of capital. Managers are said to be able to use their superior knowledge of the firm's investment opportunities to allocate capital efficiently among projects, thereby maximizing firm value. More recently, Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004) have developed models in which mergers and acquisitions are driven by stock market valuations or more precisely "misvaluations".

Taxation - Corporate income taxation provides a mechanism for increasing net cash flows through mergers. Firms can reduce expected taxes by reducing earnings volatility to the extent that corporate tax schedules are convex or to the extent that they can exploit inter-country tax arbitrage or utilize tax loss carryovers (Cummins & Weiss, 2004).

Economics Shocks - Based on empirical analysis of the 1982-1989 period, Mitchell and Mulherin (1996) assert that the waves of merger activity within industries are driven by economic shocks to industry structure such as deregulation. Andrade, Mitchell, and Stafford (2001) also support this conclusion with an analysis of merger data from the 1990s.

1.1.2 Empirical Evidence of Merger Success

Corporate mergers usually have episodic occurrences across industries within the United States and around the world. Notwithstanding the previous theoretical explanations, the empirical evidence suggests on average that little to no short-term or medium-term benefits and limited long-term benefits are achieved from merging. Hogarty (1970) found that performance of heavily merging firms to be generally worse than the average investment performance of firms in their respective industries. Additionally, he found mergers to have a neutral impact on profitability. Lev and Mandelker (1972) could not point to any clear effect of merging on riskiness of the acquiring firm,

growth rate in the post-merger years, financial structure, percentage of income taxes paid, or liquidity position of the acquiring firm. Haugen and Langetieg (1975) also found that mergers fail to produce economically significant changes in the distribution rates of return to the stockholder. Firth (1979) studied mergers and takeovers in the United Kingdom and found that on average there were no gains associated with takeovers and that there were in fact small losses.

Jensen and Ruback (1983) claimed that mergers and acquisitions create social welfare by allowing the most efficient distribution of corporate assets. They reported that successful acquiring firms earned average risk-adjusted excess returns of 3.8% with acquisitions and approximately 0% with mergers.⁵ However, these results were challenged by a flood of event studies finding negative returns to the shareholders of acquirers during the 1970s and 1980s (Sirower, 1997). Generally, these studies demonstrated that the mean returns to acquirers pursuing acquisition strategies were significantly negative, with only approximately 35% of acquisitions being met with positive stock market returns on announcement (Sirower, 1997). Even Jensen and Ruback (1983) revealed that as the event window expanded, the returns to acquiring firms deteriorated significantly.

More recently, Cummins and Weiss (2004) conducted a market model event-study of mergers and acquisitions in the European insurance industry over the period 1990-2002. They found that European mergers and acquisitions created small negative cumulative average abnormal returns for acquirers and substantial positive cumulative average abnormal returns for targets. Additionally, Moeller, Schlingemann, and Stulz (2005) examined a sample of 12,023 acquisitions by public firms from 1980 to 2001 and found that shareholders of these firms lost a total of \$218 billion when acquisitions were announced. Most merger event studies find that, in the long-term, acquiring firms are found to experience negative abnormal returns (Scherer, 1988).

Lewellen, Loderer, and Rosenfeld (1989) offered risk reduction as another explanation for merger activity. However, when they empirically tested the hypothesis, they found no evidence in their sample that risk reduction for the acquiring firm is the typical outcome or that when it occurs it

⁵Based on a relatively short event window of no more than one month before and one month after announcement.

is differentially costly for the shareholders. Some recent papers do find some positive effects from mergers (See Pillof, 1996; Rau & Vermaelen, 1998; Gugler, Mueller, Yurtoglu, & Zulehner, 2003; Ramaswamy & Waagelein, 2003). However, overall the empirical results generally show a negative long term impact on profitability.

The remainder of the paper proceeds as follows. Section 2 establishes the basis of our behavioral explanation and discusses the significance of merger integration costs. Section 3 discusses our experimental study. Section 4 presents our experimental data and results. Section 5 provides concluding remarks.

2 Behavioral Explanations

Most of the reasons put forth to explain merger activity lack a definitive theoretical basis and the empirical evidence of post-merger performance has been inconsistent at best. While the traditional theories in the merger literature are disparate, they do have two commonalities. The explanations: 1) are based on the idea that the merger decision is a rational action and 2) fail to explain completely the empirical outcomes observed.

Along slightly different lines, Roll (1986) suggested hubris as a motive for corporate takeovers and mergers. “Hubris on the part of individual decision makers in bidding firms can explain why bids are made even when a valuation above the current market price represents a positive valuation error. Bidding firms infected by hubris simply pay too much for their targets.” Empire building and overconfidence are the prominent behavioral theories that have been put forth. We accept these arguments as a partial explanation but explore the possibility that they may be acting in combination with other behavioral biases.

The focus on integration costs associated with recent high profile merger disasters suggests that there may also be biases with respect to the evaluation of merger integration costs. For example, Quaker Oats Company’s \$1.7 billion purchase of Snapple Beverage Corporation in late 1994 stands as one of the worst acquisitions of the 1990s. While the acquisition had a number of issues, the costs associated with integration often were cited as one of the primary reasons for its failure.

Still bleeding from its acquisition last year of Snapple, the Quaker Oats Company warned Wall Street today that earnings in the quarter ending Dec. 31, 1995 would fall short of expectations. Quaker also announced plans for a \$40 million pre-tax charge against earnings in the quarter, mostly to cover **the cost of getting rid of overcapacity in Snapple’s bottling operations.**⁶

⁶“Still Drained by Snapple, Quaker Sees a Big Charge” by Barnaby J. Feder, *The New York Times* - Dec. 22, 1995

Merger Integration Costs

Ex ante, savings and synergies not integration costs and restructuring costs are the focus of most mergers. However, as in the previous example, ex post integration costs are often cited as the reason for the failure of specific mergers. “.....technology integration can often cost more than expected and undermine the purpose of a merger.”⁷ Thus, we start by quantifying the magnitude of recent direct merger integration and restructuring costs.⁸

Mergers with substantial integration costs, like the Snapple merger, are not isolated incidents. When reviewing the cumulative direct integration costs⁹ of the top twenty mergers since 1998, we see that integration costs can be non-trivial¹⁰ (See Table 1). When evaluating a sample of all U.S. company mergers over \$5 billion between 1990 and 2004¹¹, we confirm that integration costs are considerable. Yearly restructuring costs as large as 15% of net revenue could be found. Upon a closer examination of average restructuring cost, we see that even five years after any given merger, the acquiring firm on average still realizes restructuring expenses. Four years after a merger, average costs are higher than the year immediately after the merger (See Figure 1).¹² Thus, our data show that the integration and restructuring costs are a significant and recurring expense associated with mergers. Consequently, any biases in assessing these costs could have profound effects on merger decisions.

⁷“The Lack of Standards is a Massive Headache” by Philip Manchester, *Financial Times* - Mar. 13, 2002, p. 16.

⁸While we focus on direct costs, in addition to the direct costs associated with merger integration, there are also indirect costs associated with the ability to manage human capital.

⁹Direct integration costs information obtained from acquiror annual reports. For mergers after 1998, number reflects the sum of all integration costs identified in annual reports from year of merger through 2004. For mergers in 1998, number reflects the sum of all integration costs identified in annual reports from year of merger through 2003.

¹⁰Rank value and deal value estimates obtained from the Thomson Financial database. Rank value is calculated by subtracting the value of any liabilities assumed in the transaction from the transaction value and by adding the target’s net debt. Net debt is straight debt plus short-term debt plus preferred equity minus cash and marketable securities as of the date of the most current financial information prior to the announcement of the transaction.

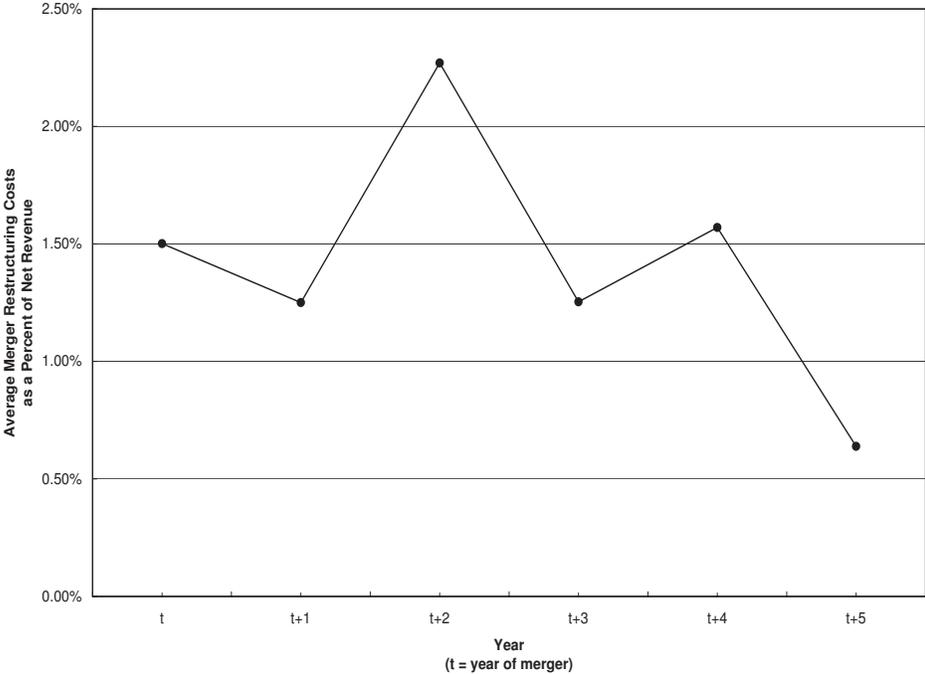
¹¹Using the Securities Data Corp. (SDC) database, we first compiled a list of all mergers over \$5 billion between 1990 and 2004. After deleting internationally based companies, we also purged our list of any transaction that was not a true merger but was a buyback, recapitalization, restructuring, or acquisition by a private equity firm/investor group/management team. Additionally, we eliminated from the sample all acquiring firms that had multiple acquisitions over any five year period. Total final sample includes 51 companies.

¹²Based on a subsample of our data so that four years after restructuring can be observed. Subsample contains 20 companies and covers mergers occurring between 1990 and 1999.

Table 1: Cumulative Direct Integration Costs for Top 20 Mergers Between 1998 and 2004

Date	Target	Acquiror	Industry	Deal Value (\$US mil)	Rank Value (\$US mil)	Integration Costs (\$US mil)
11/4/1999	Warner-Lambert Co.	Pfizer Inc.	Healthcare	89,167.7	88,771.1	13,113.0
9/13/2000	JP Morgan and Company Inc.	Chase Manhattan Corp.	Financial	33,554.6	33,554.6	6,529.0
9/15/1999	General Instrument Corp.	Motorola Inc.	Telecommunications	10,935.5	1,883.8	3,992.0
12/1/1998	Mobil Corp.	Exxon Corp.	Energy and Power	78,945.8	86,398.8	3,189.0
12/17/2001	Immunex Corp.	Amgen Inc.	Healthcare	16,900.0	16,684.6	3,000.0
9/4/2001	Compaq Computer Corp.	Hewlett-Packard Co.	Financial	25,263.4	1,915.5	2,498.0
10/16/2000	Texaco Inc.	Chevron Corp.	Energy and Power	42,872.3	43,318.3	2,139.0
8/4/1999	Union Carbide Corp.	Dow Chemical Company	Materials	11,691.5	11,813.5	1,767.0
1/14/2004	Bank One Corp.	JP Morgan Chase and Co.	Financial	58,760.6	58,760.6	1,365.0
6/8/1998	Wells Fargo Capital Corp.	Norwest Corp.	Financial	34,352.6	34,352.6	1,120.0
7/17/2000	Fort James Corp.	Georgia-Pacific Corp.	Consumer Staples	11,198.5	11,213.3	868.0
6/7/1999	Honeywell Inc.	AlliedSignal Inc.	High Technology	15,601.2	15,495.9	642.0
12/4/2000	Quaker Oats Company	PepsiCo Inc.	Consumer Staples	14,391.7	14,306.0	639.0
10/27/2003	FleetBoston Financial Corp.	Bank of America Corp.	Financial	49,260.6	49,260.6	618.0
8/3/1998	American Stores Co.	Albertsons Inc.	Retail	11,864.6	11,719.7	600.0
6/25/2000	Nabisco Group Holdings Corp.	RJ Reynolds Tobacco Holdings	Consumer Staples	11,065.5	15,151.5	597.0
9/28/2003	John Hancock Financial Services Inc.	Manulife Financial Corp.	Financial	11,062.6	11,062.6	475.0
6/21/2004	SouthTrust Corp.	Wachovia Corp.	Financial	14,155.8	14,155.8	444.0
10/19/1998	Fred Meyer Inc.	Kroger Co.	Retail	12,890.4	1,812.4	403.0
7/10/2000	SDL Inc.	JDS Uniphase Corp.	High Technology	41,143.6	40,992.6	392.8
11/17/2003	Travelers Property Casualty Corp.	St Paul Cos Inc.	Financial	16,136.1	16,136.1	300.0
8/8/2000	GPU Inc.	FirstEnergy Corp.	Energy and Power	11,826.9	10,913.7	140.0
3/29/2000	Seagate Technology Inc.	Veritas Software Corp.	High Technology	18,515.2	17,677.2	90.0
10/18/1998	HBO and Company	McKesson Corp.	High Technology	14,319.7	1,810.0	3.7

Figure 1: Average Restructuring Costs as a Percent of Net Revenue, 1990 - 1999



3 Experimental Study

Given the anecdotal and empirical evidence linking the failure of many mergers to integration issues and costs, what can we learn from an experimental study in this area? Similar to Croson, Gomes, McGinn, and Nöth (2004), this paper uses experimental methods to examine questions involving mergers and acquisitions. An experimental approach enables us to rule out many behavioral explanations such as empire building and “no information availability” bias and to focus on cognitive reasons. Thus, the experimental data may help to shape the behavioral literature on merger theory.

3.1 Discussion of Approach

Several methodologies have been employed to determine how decision-makers use information in the process of making decisions - called *process tracing* (Russo, 1977). The most prominent of these process tracing techniques involves monitoring the acquisition of information throughout the decision process (See Payne, Braunstein, & Carroll, 1978, for a review of various techniques.) Typically, information is hidden but labelled by topic. A subject is then allowed to access information as they wish, before making a decision. The experimenter tracks the information that is accessed, the order in which it is accessed, and the time spent on each topic. This is then related to the decision that is made and the data are analyzed for statistical patterns and significance.

3.2 Process Tracking Experiment

To empirically test our theory that corporate executives exhibit biases with respect to integration cost information, we use a process tracing methodology to track the decision making behavior in two separate experiments conducted in an experimental economics laboratory. We obtain data on what information subjects seek, in what order the information is acquired, how much information is acquired, and for what duration is the information examined. (For experiment instructions see Appendix A.1)

Procedure

In an experimental economics laboratory at an ivy league university, subjects were presented a series of three case studies accessed through the use of an internet browser. For each case study, the first page presented to the subject would place the participant in some decision making capacity at a firm considering the acquisition of another firm.¹³ A general description of the activities of these firms, and the potential motivation for the merger was given. At the bottom of the page was a list of hyper-linked pages labelled Competition and Market Share, Financials, Integration Issues, Legal and Regulatory Considerations, Operating Synergies, Acquiring Company Information, Target Company Information, Tax Ramifications, and Proceed to Final Decision. (For an example, see Appendix A.2) Clicking each information link would bring the individual to another page containing information on the relevant topic. Going back to the original page (to access other information or make a final decision) required the subject to reveal their current intention as to whether the firm should carry out the merger or not. Clicking on the link labelled “Final Decision” lead subjects to a page where they would recommend one of three options: i) submit a [high \$] bid to acquire the company, ii) submit a [low \$] bid to acquire the company, iii) do not bid. Subjects were informed that if they selected the [low \$] bid option, then there was only a 0.5 probability of acquiring the company.

The case studies were designed to draw attention to various aspects of a potential merger. For example, one case considered firms that operate in separate geographic regions, where merging may not allow firms to cut many jobs or shut down facilities. A sample case appears in Appendix A.2 Further, we designed the case studies to mimic the types of case studies typically presented in job interviews or MBA classroom exercises. Thus, the format was familiar to all of the subjects.

With each of the three cases, subjects were presented with one of four different “treatments”: i) high integration costs and high savings from operating synergies, ii) high integration costs and low savings from operating synergies, iii) low integration costs and high savings from operating

¹³All acquisitions are to be made using stock.

synergies, iv) low integration costs and low savings from operating synergies. The cases were presented to each individual in random order. Case versions and treatments were randomized using the same process.

Subjects were informed that the computer would track the order in which they accessed information, the time spent on each page, as well as the intermediate and final decisions for each case. Following the three case studies, subjects were asked a short series of questions regarding their experience and the importance of the information they used.

Subjects

Two types of subjects were used in this experiment: business undergraduates and business executives.¹⁴ The first group consisted of 55 undergraduate business majors at an ivy league university. The second group consisted of executive practitioners: CEOs (4), presidents (5), senior vice presidents (1) and other senior executives (5) of large companies. The executive subjects were recruited as they attended a meeting of the alumni of the same ivy league university as the undergraduate subjects. It is important to note that the this paper has better control over the subject pool than many other experiments using both professionals and students (See for example, Burns, 1985; Fehr & List, 2004; Haigh & List, 2005). The executive subjects were alumni of the same university *and* department as the student subjects.

Subject Payments

After a final decision in a case, the student subjects would be awarded points equal to the net present discounted profit realized from either the merged or non-merged company (calculated from the information in the case study). In addition, from the intermediate choices selected, the student subjects were awarded one-half the average points that would have resulted from making the corresponding final decision.¹⁵

¹⁴The composition of our subject pool is similar to Dyer, Kagel, and Levin (1989) who using both students and business executives find “similar results are reported almost without exception across” the two groups.

¹⁵This is done to make intermediate decisions incentive compatible.

The first round was played as a practice round, with subjects informed of their point totals, but not receiving any money or other compensation. Subjects were informed that they had seven minutes for each case to provide a final decision or no points would be awarded. In each of the two other cases, student subjects were paid \$5 plus approximately \$2 for every 100 points earned in the experiment.

The executive subjects received the same information as those in the student subjects. Following Fehr and List (2004), we were concerned with offering rewards that were substantial enough for the executives to take the game seriously. Fehr and List overcame this problem with Costa Rican CEOs by scaling the incentives up by a factor greater than ten for CEOs as compared to students. With a group of CEOs and other officers of large US companies, we felt the level of monetary rewards that were possible to offer to any individual would not achieve our objective. Since the amount of money we could provide as incentive for the executive subjects was not likely to be salient, no monetary rewards were given. Rather, prior to participation, it was announced that point totals would be announced by name to all participants with the participant obtaining the highest point total receiving a university alumni director's chair (valued over \$400) and the participants with the next four highest point totals receiving coffee table books. Post experimental debriefings suggest that the executives took the experiment very seriously, and desired to do well.

4 Data and Results

4.1 Data Overview and Summary Statistics

There were a total of 2,333 decisions observations from the two experiments. 2,034 of the total observations were from student subjects while 299 of the total observations were from executive subjects. Executives were less likely to decide in favor of a merger (See Table 2). However, evidence suggests that this was not due to risk aversion. We see that executives did not “display risk aversion”¹⁶ significantly more than students (See Table 3). With a p-value of 0.9475, the difference in means test confirms that there was no evidence of a difference in “displaying risk aversion.” A higher percentage of the students did exhibit more “risk seeking”¹⁷ than the executives (See Table 4). However, the difference in means test indicates that there also was little evidence of a difference in risk loving. While we cannot reject the null that the means are the same, the p-value of 0.5127 does caution us that this could be due to a sample size issue.

¹⁶*Displayed risk aversion* being defined as giving up expected value to reduce risk. Given choices A and B, where A had a weakly lower expected value than B but lower risk, choice A is a risk averse choice. Choice B is inconclusive.

¹⁷*Displayed risk seeking* being defined as giving up expected value to increase risk. Given choices A and B, where A had a weakly lower expected value than B but higher risk, choice A is a risk loving choice. Choice B is inconclusive.

Table 2: Subject Decisions

	Number of Final Decision Obs.	% Did Not Bid	% Bid Low Price	% Bid High Price
Students	165	24%	46%	30%
Executives	45	40%	42%	18%

Table 3: Subject Performance - Displayed Risk Aversion

Displayed Risk Aversion	Students	Executives
Yes	30%	31%
No	70%	69%

Table 4: Subject Performance - Displayed Risk Seeking

Displayed Risk Seeking	Students	Executives
Yes	53%	42%
No	47%	58%

4.2 Decision Making Results

4.2.1 Subject Information Seeking and Evaluation

Executives reviewed an average of 20 information pages prior to making a final decision, while the students reviewed 37 (85% more) information pages before making a final decision. This was not due to any sort of time constraint since, on average, the executives spent less total time per case (269 seconds) than the students (283 seconds). Generally, the maximum time allowed per case (7 minutes) was not a binding constraint for any of the subjects.

Conditional on visiting the operating synergies page, executives spent approximately the same average amount of time reviewing the operating synergies information (Executives - 7.9 seconds; Students - 7.0 seconds). Conditional on visiting the savings page executives spent approximately the same average amount of time reviewing the savings information (Executives - 41.1 seconds; Students - 38.2 seconds). Difference in means tests reveal that both of the differences in student and executive average times are not significant (p-value of 0.41 for the operating synergy page and a p-value of 0.41 for the savings page).

While we see that the executives and students reacted to synergy and savings information similarly, that is not the case with integration issues and cost information. The main differences in the behavior of the executives and students come with respect to the integration issues and cost pages. Conditional on visiting the integration issues page, executives spent much less time than students reviewing the information (Executives - 31.7 seconds; Students - 40.9 seconds). A difference in means test indicates that this difference is significant with a p-value of 0.02. Conditional on visiting the cost page, executives and students spent approximately the same amount of time (Executives - 24.3 seconds; Students - 27.0 seconds, p-value of 0.52).

Executives and students had similar page visitation patterns except with respect to the integration issues, cost, competition, and target company financials information (See Figure 2). The most

Figure 2: Page Visitation Patterns

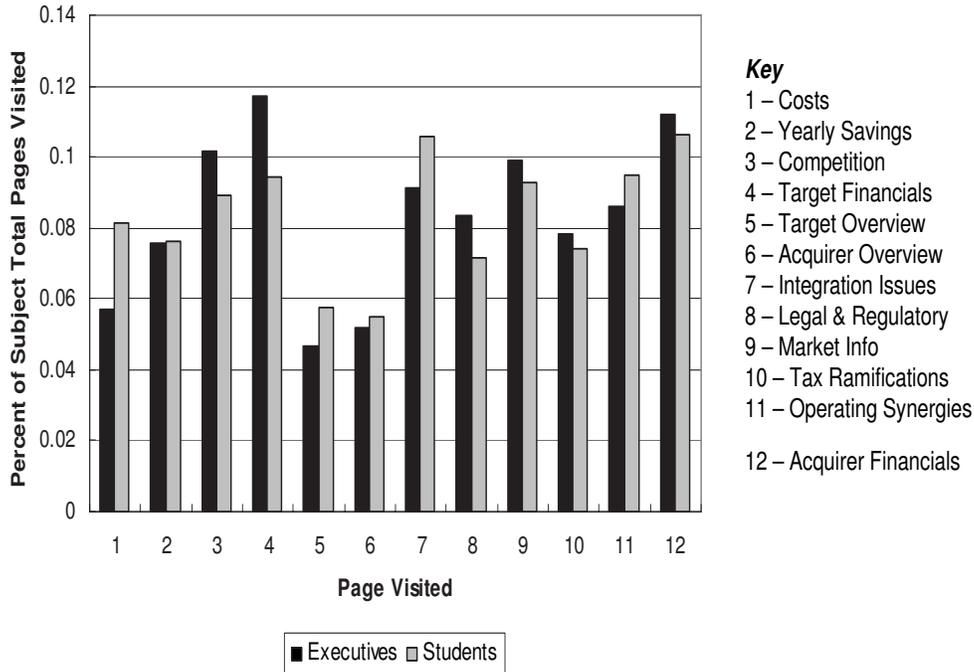


Table 5: Integration Issues and Costs

	% that did NOT look at integration issues	% that did NOT look at costs
Students	6.7%	18.8%
Executives	28.9%	51.1%

striking differences are with the integration issues and cost page visitation between executives and students. While 93.3% of the students visited pages pertaining to integration issues, only 71.1% of executives visited the integration issues pages. Additionally, 81.2% of the students visited the cost pages with only 48.9% of the executives looking at any cost related information before making a final decision (See Table 5). The fact that fewer executives visited the integration issues and cost pages has big implications when we consider that whether or not a subject reviewed a particular piece of information had ramifications for how the subject bid.

4.2.2 Decision Changes

In the total sample, several pages influenced subjects to change from a no bid to a yes bid (See Figure 3). Yet, when comparing the differences between students and executives we see that many different pages influenced students to change from a no bid to a yes bid but the savings page was the chief influence for executives (See Figure 4). The cost page was the primary page that influenced both students and executives to change from a yes bid to a no bid (See Figure 5). However, if we look *beyond* the cost pages when comparing the differences between students and executives, we see that executives were more influenced by the acquiring company's information and financials while students were more influenced by the target company's financials (See Figure 6).

In addition to fewer types of pages influencing executives to change their decisions, we also observed that executives were less likely than students to change their decisions at all. The probability density of decision conditional on previous decision shows that executives had more inertia in their decision making and had fewer big swings (See Table 6, Figure 7, & Figure 8).

Figure 3: Pages Which Caused Subject to Change from a No Bid to a Yes Bid - Total Sample

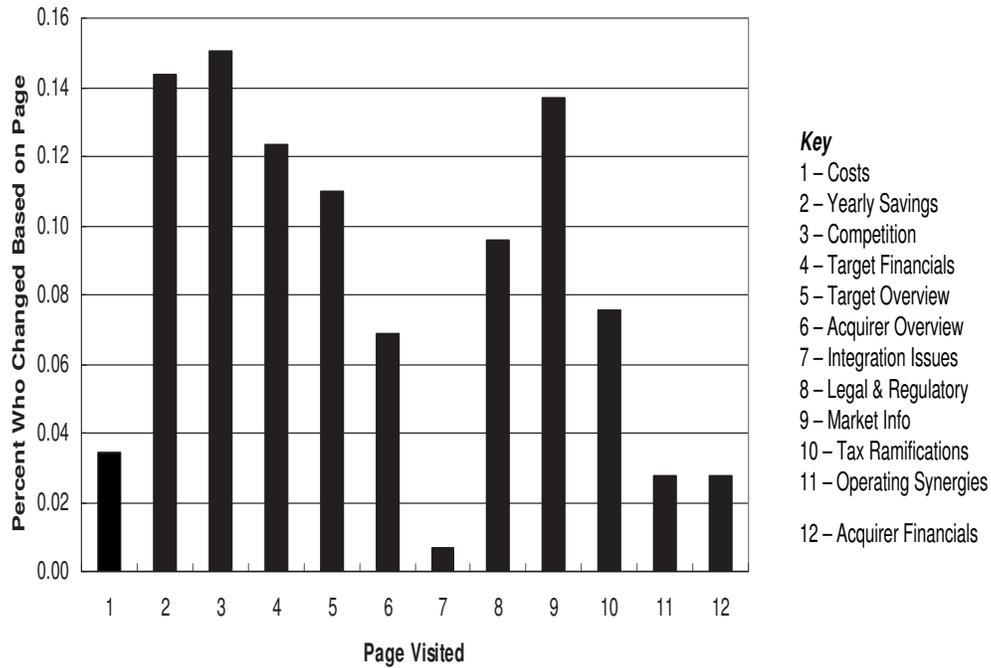


Figure 4: Pages Which Caused Subject to Change from a No Bid to a Yes Bid

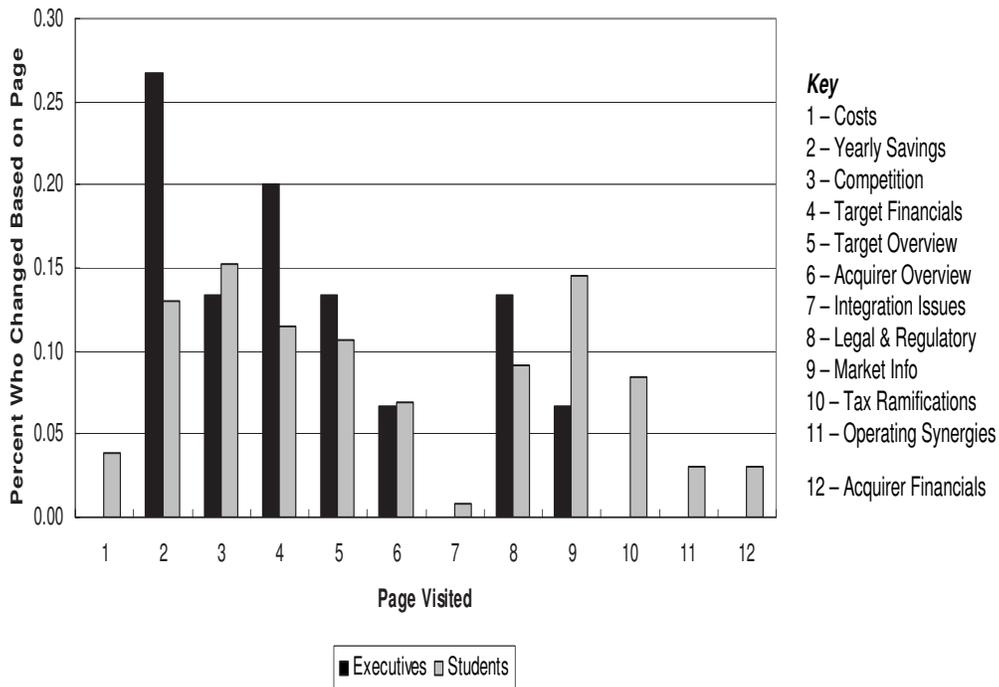


Figure 5: Pages Which Caused Subject to Change from a Yes Bid to a No Bid - Total Sample

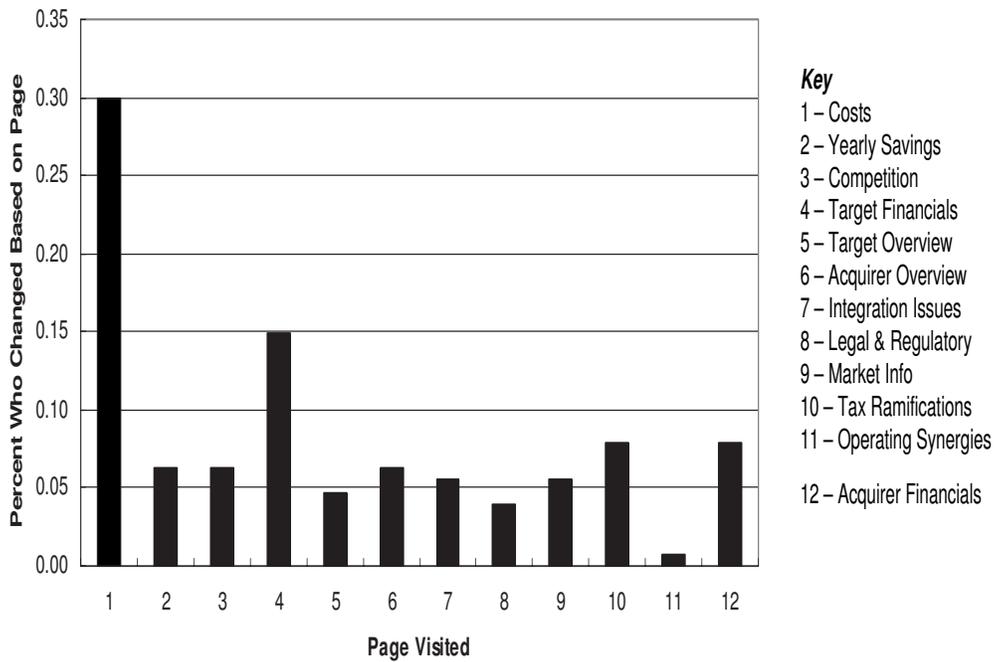


Figure 6: Pages Which Caused Subject to Change from a Yes Bid to a No Bid

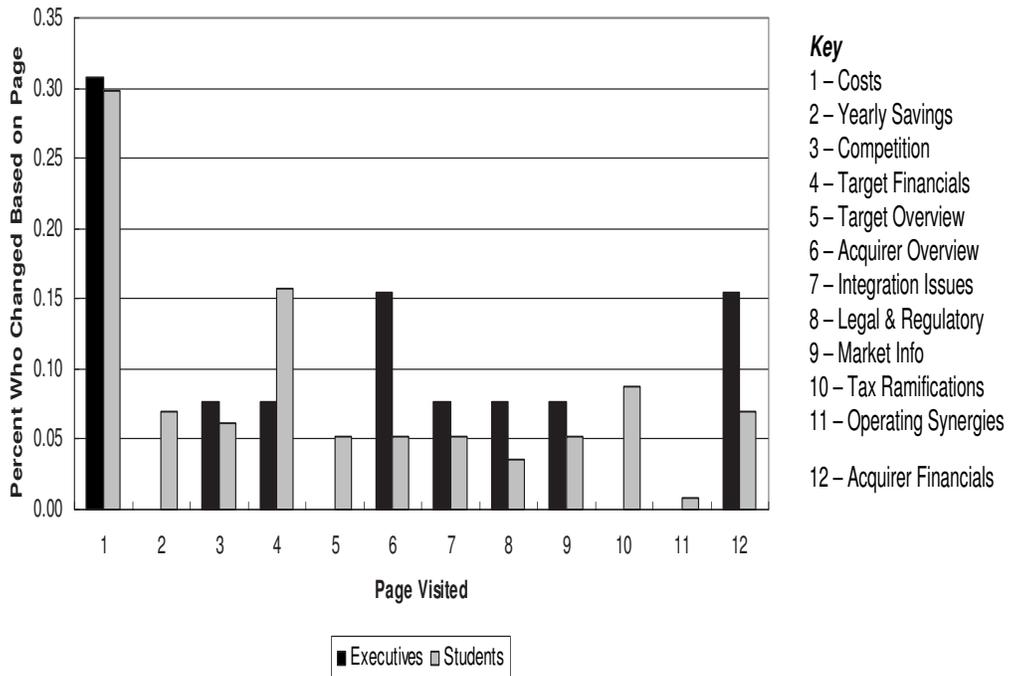


Table 6: Probability Density of Decision Conditional on Previous Decision

Decision	Previous Decision								
	Total Sample			Executives			Students		
	\$100m Bid	\$75m Bid	No Bid	\$100m Bid	\$75m Bid	No Bid	\$100m Bid	\$75m Bid	No Bid
\$100m Bid	66%	14%	4%	88%	9%	2%	63%	14%	5%
\$75m Bid	25%	72%	23%	12%	76%	11%	27%	72%	27%
No Bid	8%	14%	72%	0%	15%	88%	10%	14%	68%

Figure 7: Probability Density of Decision Conditional on Previous Decision - Executives

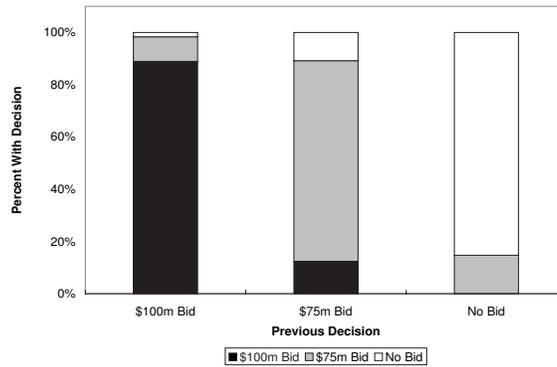


Figure 8: Probability Density of Decision Conditional on Previous Decision - Students

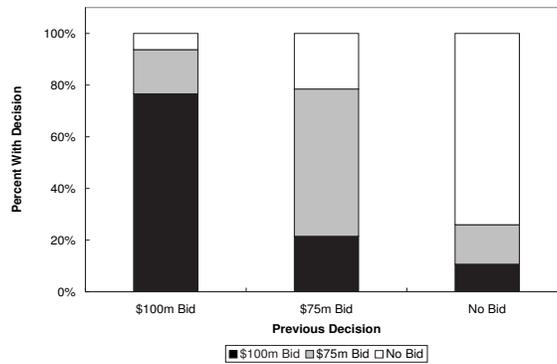


Table 7: Confirmation Bias Characterization

If Subject:			Then Subject:	
Views	Integration Issues	Views Costs	Bids	Exhibits Confirmation Bias
No		No	Yes	Yes
No		No	No	Yes
Yes		No	Yes	Yes
Yes		No	No	No
Yes		Yes	Yes	No
Yes		Yes	No	No

4.3 Confirmation Bias

Confirmation bias is generally described as a situation in which an individual attaches too much importance to information that supports his views relative to information that runs counter to his views (Shefrin, 2006). While much of the research on confirmation bias focuses on the scrutiny applied to new information, evidence suggests the problem is much deeper. Confirmation bias also determines the type of information individuals seek. In the context of our experiment, we define confirmation bias as a subject not seeking additional information which could potentially change the final decision. The data suggest that a significant majority had a predisposition to go with the merger at the beginning of each case. Consequently, we examine the data for evidence of avoiding negative/disconfirming information with respect to the merger (i.e., integration issues and cost information). Table 7 summarizes how we define subject confirmation bias.

Using the characterization provided in Table 7, we find that 40.0% of the executive decisions involved confirmation bias with respect to integration issues and cost information compared with only 17.6% of the student decisions. Thus, the executives were less likely to change their decisions and less likely to review information that had the greatest potential to affect the final decision. We take these results as strong evidence of the existence of confirmation bias in the executive subjects.

The different decision making processes between executive and student subjects also produced different results. When scores were calculated based on the net present discounted profit realized

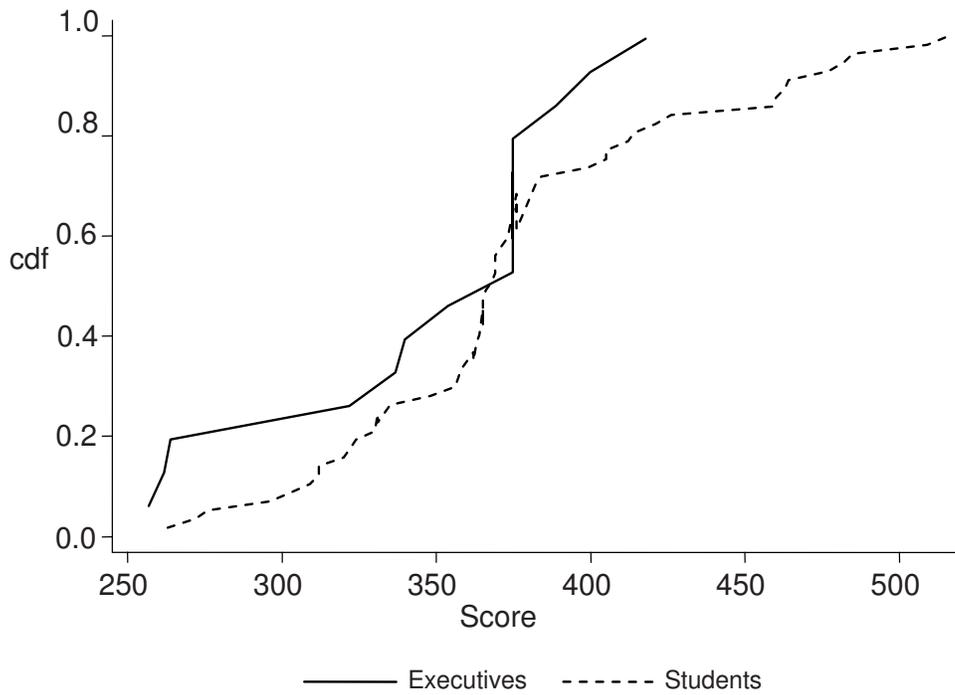
from either the merged or non-merged company, the average performance of the student subjects was better than that of the corporate executives (See Table 8). This is further illustrated by a graph of the the cumulative distribution functions of executive and student scores which reveals that the students scores nearly first order stochastic dominated the executive scores *except for around the mean score* (See Figure 9). This result, while somewhat surprising, is consistent with other experimental findings. For example, Haigh and List (2005) documented that professional traders exhibited stronger behavioral biases than student subjects. In an experimental setting they found that the investment behavior of professional traders was consistent with myopic loss aversion to a *greater* extent than student subjects.

Given the strong experimental evidence in support of the existence of a confirmation bias in the next subsection, we suggest a theoretical confirmation bias model which may help us to describe and better understand merger and acquisition decision making behavior.

Table 8: Subject Performance - Score

	Score				
	Mean	Std. Dev.	Median	Max	Min
Students	374	59	366	516	263
Executives	349	51	376	419	258

Figure 9: Cumulative Distribution Functions of Executive and Student Scores



4.4 Theoretical Confirmation Bias Model

Ross and Anderson (1982) describe how confirmation bias can lead to the persistence of false beliefs. Lord, Lepper, and Ross (1979) show that given an initial set of beliefs, individuals will tend to take new information confirming their beliefs as beyond question, while subjecting disconfirmatory information to intense scrutiny. Such a process would lead individuals to become more and more certain of whatever initial belief they have. We will call this process *verification*.

In terms of confirmation bias influencing the type of information individuals seek, Wason (1968) gives a simple illustration of this effect in which a subject is shown four cards with ‘E,’ ‘K,’ ‘4,’ and ‘7’ written on the exposed face. Subjects are told that each card has a letter written on one side, and a number written on the other side. Further, the subjects are given a hypothesis to test: Every card with a vowel on one side has an even number on the other side. Subjects are then asked which cards must be turned over to test the hypothesis. Most respond that ‘E’ and ‘4’ should be turned over. Turning over the ‘E’ and finding an odd number would disconfirm the hypothesis. However, turning over a ‘4’ and finding a consonant would provide no information. Turning over the ‘4’ could only provide confirming evidence (as would turning over the ‘E’ and finding an even number). Alternatively, almost no subjects think to turn over the ‘7.’ Turning over the ‘7’ and finding a vowel would provide disconfirming evidence, while finding a consonant would provide no information regarding the hypothesis. Thus, it appears individuals will seek any information that is possibly confirming, while shunning information that can only disconfirm prior beliefs or individuals do not understand contra positives. We will refer to this behavior as *selection bias*.

When a potential merger arises, new information must be sought concerning the profitability to the acquiring firm regarding the merger. Much like the hypothesis from Wason’s study, all information is sought to answer a specific question, “Should we acquire *Company X*?” Asking the question in this way naturally delineates nearly all information into the categories of positive (or possibly confirming) and negative (or possibly disconfirming) information. Items dealing with the costs of integrating the new firm are closely associated with not going through with a merger, while

information regarding the potential savings and synergies are closely associated with executing the merger.

Given a set of mutually exclusive potential transaction research requests (or what are more commonly called message services in the information economics literature) $S = \{s_1, s_2, \dots, s_n\}$, the decision-maker must determine which to pursue based on prior information in order to make the merger decision. The standard economic solution to this problem would suggest that the decision maker maximize his expected utility of profit, using Bayesian updating.¹⁸ Consider the simple case where the decision-maker can either decide to “merge” and receive profit equal to Π_r with an accompanying probability distribution or “not merge” and receive the certain amount $\bar{\Pi}$. Let the probability distribution of Π_r be given by:

$$f(\Pi_r) = \begin{cases} p_h & \text{if } \Pi_r = \Pi_h > \bar{\Pi} \\ p_l & \text{if } \Pi_r = \Pi_l < \bar{\Pi}. \end{cases} \quad (1)$$

where $r = h$ (high) or l (low), and p_r is the true probability of Π_r occurring.

Let the prior probability of high and low profits be given by π_h and π_l respectively. Let the potential messages returned by message service i be given by $m_i^1, m_i^2, \dots, m_i^T$, with respective probabilities $q_i^1, q_i^2, \dots, q_i^T$. Let $\phi(m_j^i)$ be the likelihood of receiving message j from message service i given Π_r . Thus, the expected utility of message service i would be given by:

$$EU\Pi_r = \sum_{j=1}^J q_j^i \max \left\{ \frac{\pi_h \phi(m_j^i | \Pi_h)}{q_j^i} U(\Pi_h) + \frac{\pi_l \phi(m_j^i | \Pi_l)}{q_j^i} U(\Pi_l), U(\bar{\Pi}) \right\}. \quad (2)$$

A message service creates value by altering the perceived probability of high or low profit resulting from the merger, thus increasing the probability of a larger profit resulting from the merger choice. If, for example, the prior probabilities suggested going ahead with the merger, the average value of a signal (in terms of the standard utility model) would be given by

$$v(s_i) = \sum_{j=1}^J q_j^i \left\| \max \left\{ \frac{\pi_h \phi(m_j^i | \Pi_h)}{q_j^i} U(\Pi_h) + \frac{\pi_l \phi(m_j^i | \Pi_l)}{q_j^i} U(\Pi_l), U(\bar{\Pi}) \right\} - \left\{ \frac{\pi_h \phi(m_j^i | \Pi_h)}{q_j^i} U(\Pi_h) + \frac{\pi_l \phi(m_j^i | \Pi_l)}{q_j^i} U(\Pi_l) \right\} \right\|. \quad (3)$$

¹⁸Hirshleifer and Riley (1992), p. 170 - 178.

The model in 3 suggests that value can only be created if the resulting behavior changes. However, confirmation bias suggests that this is not the case. Rather, individuals add value by confirming the decisions they have made prior to obtaining the information. Thus, we propose the following behavioral model of confirmation bias

$$V(s_i) = \sum_{j=1}^J q_j^i \left\| \max \left\{ \frac{\pi_h \phi(m_j^i | \Pi_h)}{q_j^i} U(\Pi_h) + \frac{\pi_l \phi(m_j^i | \Pi_l)}{q_j^i} U(\Pi_l), U(\bar{\Pi}) \right\} - \{ \pi_h U(\Pi_h) + \pi_l U(\Pi_l) \} \right\|. \quad (4)$$

Here, value is created where the posterior probabilities disagree with the prior probabilities. All informational outcomes are compared to the (potentially false) distribution of outcomes encompassed in the prior. Thus, information increasing the possibility of a positive outcome from a decision, but not changing the decision, will result in increased value. Further, the process of verification makes it such that any signal that disagrees with the prior information (or the favored answer) will be discounted or ignored. Thus, let the decision-maker learn according to a form of the generalized Bayes rule (e.g. Grether, 1980) called the limited learning model (Just, 2001). The perceived probability of Π_r occurring is $p(\Pi_r | m_j^i) = \frac{\pi_r \phi(m_j^i | \Pi_r)^{k(\pi_h - \nu_h)}}{q_j^i}$, where $\nu_h = \frac{\phi(m_j^i | \Pi_h)}{\phi(m_j^i | \Pi_h) + \phi(m_j^i | \Pi_l)}$ is the normalized likelihood and $k \in [0, 1]$ is a geometric weight given to the likelihood information as a function of the geometric distance between the prior and the normalized likelihood (so that $\nu_h + \nu_l = 1$) of the favored outcome. Let $k(\cdot)$ be monotonically decreasing in its argument, so that the lower the difference between prior probability of the high profit and the probability suggested by the information signal, the more the signal is interpreted as a uninformative signal (where $k = 0$ implies the individual interprets the likelihood function as a uniform distribution, conveying no new information). In other words, k is the weight given to new information and is a function of the type (confirming or nonconfirming) of information. When comparing the value of message services, the signals that receive the lowest weight k will also convey the least value, as it does not change the posterior probabilities. Thus, message services that are likely to contradict the prior probability are the least likely to be chosen, while those that confirm beliefs are the most likely to be chosen. Consequently, selection bias is a natural consequence of verification behavior.

When we transform equation 4 into its normalized likelihood form where $\nu_{lj}^i = 1 - \nu_{hj}^i$, we have:

$$V(s_i) = \sum_{j=1}^J q_j^i \left\| \max \left\{ \frac{\pi_h (\nu_{hj}^i)^{k(\pi_h - \nu_{hj}^i)}}{B_j^i} U(\Pi_h) + \frac{\pi_l (1 - \nu_{hj}^i)^{k(\pi_h - \nu_{hj}^i)}}{B_j^i} U(\Pi_l), U(\bar{\Pi}) \right\} - \pi_h U(\Pi_h) - \pi_l U(\Pi_l) \right\|. \quad (5)$$

where $B_j^i = \pi_h (\nu_{hj}^i)^{k(\pi_h - \nu_{hj}^i)} + \pi_l (1 - \nu_{hj}^i)^{k(\pi_h - \nu_{hj}^i)}$ is the Bayes' factor for contingent j of signal i , and ν_{hj}^i is the normalized likelihood of event h given signal j of service i . Let the decision be such that if the perceived probability of a high outcome falls under \bar{p} , then the individual decides to take $\bar{\Pi}$.

Proposition 1: *Let s_1 and s_2 be two message services each with two possible messages: $\nu_{h1}^1 = \nu_{h1}^2 = \pi_h$, $\nu_{h2}^2 < \nu_{h2}^1 < \pi_h$, and $q_1^1 = q_2^1$. Then, message service 1 will be weakly preferred to signal 2 if $\nu_{h2}^1 < \frac{1}{2}$ and if $\frac{\partial k(\pi_h - \nu)}{\partial \nu}$ is below a specified bound.¹⁹*

If there are two message services, each with two possible messages that arrive with equal probabilities, service one having a confirming and a disconfirming message (*synergy information*), service two having a confirming (identical to service one) and a more severely disconfirming message (*cost information*), the service that has the less severely disconfirming service will be preferred. This will always be the case if the probability of success in the severely disconfirming case is below $\frac{1}{2}$ and if disconfirming information is sufficiently discounted. (Proof is contained in Appendix B.1.)

Proposition 2: *Let s_1 and s_2 be two message services each with two possible messages: $\nu_{h1}^1 = \nu_{h1}^2 = \pi_h$, $\nu_{h2}^2 < \pi_h$, and $q_1^1 > q_2^1$. Then, message service 1 will be strongly preferred to signal 2.*

If there are two message services, each providing the same two possible messages (one confirming and one disconfirming), then the message service with the higher probability of the confirming message will be preferred. (Proof is contained in Appendix B.2)

When evaluating mergers, our conjecture is that executives exhibit a sort of selection/confirmation bias. Within the context of a merger, cost information may be thought to have greater potential

¹⁹Bound defined in proof found in Appendix B.1

to disconfirm the merger, while information on savings may more likely confirm the merger. Thus we expect individuals will regard cost and savings information very differently depending on their prior inclination toward the merger.

5 Concluding Remarks

There is strong evidence that executives seek and evaluate merger information differently from non-executives. Executives review fewer pages of information than students and they are less likely to change their minds after reviewing new information. Since we observe that the student subjects reviewed 85% more pages of information than executive subjects, there is initial evidence to support a search cost story. (i.e., Executives have higher search costs and thus search less for information in general.) However, we observe that the executives specifically ignore integration issues and cost information relative to our student subjects. Given that the experimental setting creates a situation where all search costs are equivalent, a pure search cost story would not fully explain the results.

While executives and non-executives seem to access and evaluate the operating synergies and savings information similarly, the most striking differences between executives and non-executives come with respect to the integration issues and cost pages. For example, over 80% of the students accessed the integration cost information while over 50% of the executives made a final merger decisions without even looking at any associated cost information. This asymmetry is our strongest evidence of a confirmation bias when it comes to integration cost information. Consequently, as was shown by Rabin and Schrag (1999), “an agent may with positive probability come to believe with near certainty in the wrong hypothesis.” Our data also show that this executive confirmation bias generates sub-optimal decisions. That fact that the executives perform worse than the student subjects, supports our assertion that confirmation bias could lead to misguided merger decisions and is consistent with the general evidence that most mergers generate long run negative abnormal returns for the acquiring firm.

Appendix

A Business Case: MediProd, Inc.

A.1 General Subject Instructions

You are now taking part in an economics experiment designed to study the decision making process of individuals participating in merger and acquisition decisions. At any time you wish, you may decide to withdraw from the experiment. Simply raise your hand and instruct our assistant. Throughout this experiment, you will be awarded points based on your own decisions and may win a prize based on your point total. The computer will record each of the links or buttons that you press and the time that you press it. Please do not converse with other subjects, or attempt to obtain information from their actions. We also ask that you do not write during the experiment.

While you will each be asked to perform similar tasks, the order and some parameters of these tasks may be substantially different. In each of three rounds, you will be brought to a screen describing your position in a firm considering the acquisition of another firm, and some of the fundamental reasons behind this potential acquisition. We will call this screen the Main Page. Also, on the Main Page will be links to various types of information that may or may not be useful in making the acquisition decision. The information links. Will include: competition/market share information, company information, financials, integration issues, legal & regulatory issues, operating synergies, and tax ramifications.

From the Main Page you can follow any number of the information links you like in any order to obtain the corresponding information. Following an information link will bring you to a page briefly describing some pertinent information and two buttons: 'Return to Main Page' and 'Make a Final Decision'. If you select 'Return to Main Page', you will first be directed to an Intermediate Decision Page where you will be required to click on a button indicating the decision you would make should you be barred from receiving any more information. If you select 'Make a Final Decision', you will be prompted to click on a button corresponding to your final decision. If you select 'CANCEL' on the Make a Final Decision Page, you will first be directed to the Intermediate Decision Page before being returned to the Main Page.

In each round you will have a maximum of 7 minutes to view the information links. The computer will begin counting down from the time you reach the Main Page for that round. If at the end of 7 minutes you have not recorded a final decision you will automatically be brought to the final decision screen (although without a 'CANCEL' button). In rounds one and two after you have made a final decision, you will be brought to a screen reporting your score for the round and displaying a button labeled 'NEXT'. Pressing the 'NEXT' button will begin the next round and bring you to the Main Page for that round.

In each round points will be awarded based on the short term (4 years) flow of profits to your company resulting from the actions that you have taken either to acquire or not to acquire. Your

final score will be based on the points resulting from your final decision plus one-half the average points awarded based on all intermediate decisions.

While enough information within the information links will be presented to calculate this flow, it is doubtful that you will have time to access all of the information and perform these calculations. Thus, you must prioritize the information that you access. At the end of the experiment, the individual with the greatest point total will be revealed to all participants and awarded a prize.

The first round of the experiment is a practice round. Point totals for this round will not count toward the prize. When you are told “now”, please press the ‘START’ button and begin the practice round. At the end of this round, please do not advance to the next round. After all have finished the practice round, someone will answer any remaining questions that you may have.

A.2 Sample Business Case - CEO Version



University
Undergraduate Business Program

Merger Decision Making

MediProd, Inc. – CEO Version

You are the President and Chief Executive Officer of MediProd, Inc. It is late on Friday September 23, 2005 and you are sitting alone in your New York office considering a potential acquisition that would forever change your company. Your medical device manufacturing company is positioned to acquire a rival business, Smith Medical Devices. MediProd, with net sales of around \$100 million, would be the acquiring firm. However, in actuality, this would be a "merger of equals" since Smith has net sales of around \$90 million.

There is a strategic fit between MediProd and Smith. Yet, you cannot ignore the other issues that have been the downfall of numerous other mergers. You are scheduled to make a recommendation to the board on Monday. The board members have their own varied opinions, but you know that they will go with your recommendation on whether or not to proceed with the merger. As you consider your options, you again review the relevant decision making information.

Relevant Decision Making Information

Time Remaining

6:48

Smith Company Information	Integration Issues	Legal and Regulatory
Market Information	Tax Ramifications	Competition/Market Share
Financials	MediProd Company Information	Operating Synergies
Final Decision		

Competition/Market Share

MediProd has three major competitors (Smith Medical Devices, MegaMed, and M&D, Inc.) all of whom are very price competitive in order to grow their share positions in both the U.S. and the European markets. Historically, the top 4 companies (MediProd, Smith, MegaMed, and M&D) have controlled around 65% of the market with the remainder of the market share divided among 30 or so smaller manufacturers.

MediProd Financials

MediProd, Inc. - Selected Financial Data (dollars in thousands)

	<u>2004</u>	<u>2003</u>	<u>2002</u>
Net Sales	\$101,675	\$ 90,865	\$ 86,090
Cost of Sales	63,136	55,954	56,203
Gross Profit	38,539	34,911	29,887
Selling, General, and Administrative Expenses	34,411	27,965	28,573
Operating Profit	4,128	6,946	1,314
Interest Income (Expense)	(207)	(4,436)	847
Other Income(Expense)	(13)	(103)	782
Income Tax Benefit (Expense)	(2,320)	(1,433)	(809)
Net Income (Loss)	\$ 1,588	\$ 974	\$ 2,134

MediProd, Inc. - Balance Sheet at period end (dollars in thousands)

	<u>2004</u>	<u>2003</u>
Cash and Cash Equivalents	\$1,959	\$ 1,252
Other Assets	134,164	63,021
Total Assets	133,123	64,273
Total Debt	414	33,131
Other Liabilities	12,298	30,172
Total Liabilities	12,712	63,303
Shareholders' Equity	123,411	970

Other MediProd, Inc. Financial Information

- MediProd intends to make the Smith acquisition by issuing stock.
- MediProd's discount rate is 4%.

Smith Financials

Smith Medical Devices - Selected Financial Data (dollars in thousands)

	<u>2004</u>	<u>2003</u>
Net Sales	\$ 89,859	\$ 80,981
Cost of Sales	59,335	50,026
Gross Profit	30,524	30,955
Selling, General, and Administrative Expenses	29,713	28,890
Operating Profit	811	2,065
Interest Income (Expense)	(105)	(999)
Other Income (Expense)	(155)	(262)
Income Tax Benefit (Expense)	(703)	(638)
Net Income (Loss)	\$(152)	\$ 166

Integration Issues

- The CEO of MediProd and Smith have completely opposite backgrounds and management styles and their respective management teams reflect their different personalities. Since the Smith CEO is not expected to retire, it is still unclear how the two groups would be integrated.
- While large yearly costs savings from the rationalized company are eventually expected, there are significant one time integration costs that will be spread out over several years. These costs are mainly concentrated in the following areas: IT, plant closures, severance.

Integration Costs

- IT - With sales forces dispersed across the globe, new IT systems will be needed to integrate the sales teams to enable them to sell complete solutions. (estimated cost: \$5,000,000)
- Plant closures - It is estimated that approximately 50% of the Smith manufacturing facilities will need to be closed. (estimated cost: \$2 million)
- Severance - An estimated 30% of the current Smith workforce will need to be laid off. (estimated cost: \$9 million - 300 @ \$30,000 each)
- Other Merger Related Administrative Expenses (estimated cost: 1% of purchase price.)

Legal and Regulatory Considerations

An antitrust review indicates that there may be difficulty in avoiding a challenge during the Hart-Scott-Rodino (HSR) filing process.

Market Information

- MegaMed is a large competitor of MediProd. MegaMed recently acquired one of the smaller (but very profitable) manufacturers of 1 times revenue (\$10 million).
- M&D Inc. (with a similar financial profile to Smith) currently trades on the stock exchange for a price which equates to $\frac{1}{2}$ times revenue.
- The medical devices market is expected to grow by 4% over the next five years.

MediProd, Inc. Company Information

MediProd, Inc. designs and manufactures medical devices - syringe pumps, fluid & drug delivery and respiratory products - used in the care and treatment of patients around the world. MediProd offers solutions for the entire continuum of care, providing critical care systems and products to hospitals, healthcare systems and alternate healthcare settings in more than 75 countries through a global sales force and distribution network. In total, it manufactures and markets more than 2,000 products worldwide. Over the past 40 years the company has grown to over 1,000 employees. MediProd's current profitability strategy entails developing new products (i.e., recently introduced new 24-gauge catheter for the NICU), and decreasing manufacturing costs through a manufacturing rationalization program.

Operating Synergies

- MediProd executives feel that the acquisition of Smith along with its vascular access product line would enable MediProd to augment an already comprehensive product line with intravenous catheters. Ideally, this acquisition could position MediProd as one of the world's leading critical care companies which could enable the company to offer complete system solutions to distributors, hospital and alternate care facilities.
- While there is a good deal of overlap in terms of facilities, Smith has some key manufacturing plant locations that would greatly enhance MediProd's current operations.
- Large yearly cost savings are expected.

Yearly Cost Savings

- Elimination of redundant management and staff (estimated savings: \$6 million/year)
- Rationalization of manufacturing operations (estimated savings: \$250,000/year)
- Closing of Smith's back office operations (estimated savings of \$100,000/year)

Smith Medical Devices Company Information

Smith manufactures and markets around 1000 medical devices. However, the vascular access product line comprises 75% of its business. Smith has approximately 900 employees worldwide, including its own global sales force and distribution network. Smith would view this acquisition as a friendly one. The possibility has been discussed and has the blessing of the board. The CEO of Smith, who could best be described as your complete opposite in terms of personal background and management style, is expected to retire if the merger goes through. However, the management team that he has put in place over the past 15 years definitely reflects his personality.

Tax Ramifications

It is believed that there will not be any significant tax ramifications as a result of the merger.

B Proof of Propositions

B.1 Proof of Proposition 1

Proposition 1: *Let s_1 and s_2 be two message services each with two possible messages: $\nu_{h1}^1 = \nu_{h1}^2 = \pi_h$, $\nu_{h2}^2 < \nu_{h2}^1$, and $q_1^1 = q_2^1$. Then, message service 1 will be weakly preferred to signal 2 if $\nu_{h2}^1 < \frac{1}{2}$ and if $\frac{\partial k(\pi_h - \nu)}{\partial \nu}$ is below a specified bound.*

Using equation 5, let us consider $V(s_1) - V(s_2)$. $V(s_1) - V(s_2)$ can fall into three regimes.

I. If $\frac{\pi_h(\nu_{h2}^2)^{k_2}}{\pi_h(\nu_{h2}^2)^{k_2} + \pi_l(1-\nu_{h2}^2)^{k_2}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l)$, $\frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1-\nu_{h2}^1)^{k_1}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) < U(\bar{\Pi})$, so that the disconfirming signal from either message service leads the decision-maker to not invest, then we have:

$$\begin{aligned} V(s_1) &= (1 - q_1^1) [U(\bar{\Pi}) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l)] \\ V(s_2) &= (1 - q_2^1) [U(\bar{\Pi}) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l)] \end{aligned}$$

$$V(s_1) - V(s_2) = (q_2^1 - q_1^1) [U(\bar{\Pi}) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l)] = 0. \quad (6)$$

II. If $\frac{\pi_h(\nu_{h2}^2)^{k_2}}{\pi_h(\nu_{h2}^2)^{k_2} + \pi_l(1-\nu_{h2}^2)^{k_2}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) < U(\bar{\Pi}) < \frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1-\nu_{h2}^1)^{k_1}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l)$, so that the individual will still choose to invest if the less disconfirming signal is received, then we have:

$$\begin{aligned} V(s_1) &= (1 - q_1^1) \left[\frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1-\nu_{h2}^1)^{k_1}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l) \right] \\ V(s_2) &= (1 - q_2^1) [U(\bar{\Pi}) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l)]. \end{aligned}$$

Thus,

$$V(s_1) - V(s_2) = (1 - q_1^1) \left[\frac{\pi_h(\nu_{h2}^2)^{k_2}}{\pi_h(\nu_{h2}^2)^{k_2} + \pi_l(1-\nu_{h2}^2)^{k_2}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) - U(\bar{\Pi}) \right] > 0. \quad (7)$$

III. If $U(\bar{\Pi}) < \frac{\pi_h(\nu_{h2}^2)^{k_2}}{\pi_h(\nu_{h2}^2)^{k_2} + \pi_l(1-\nu_{h2}^2)^{k_2}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) < \frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1-\nu_{h2}^1)^{k_1}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l)$, so that the individual will continue to invest no matter which signal is received, then we have:

$$\begin{aligned} V(s_1) &= (1 - q_1^1) \left[\frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1-\nu_{h2}^1)^{k_1}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l) \right] \\ V(s_2) &= (1 - q_2^1) \left[\frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1-\nu_{h2}^1)^{k_1}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l) \right]. \end{aligned}$$

Thus,

$$V(s_1) - V(s_2) = (1 - q_1^1) [U(\Pi_h) - U(\Pi_l)] \left[\frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1 - \nu_{h2}^1)^{k_1}} - \frac{\pi_h(\nu_{h2}^2)^{k_2}}{\pi_h(\nu_{h2}^2)^{k_2} + \pi_l(1 - \nu_{h2}^2)^{k_2}} \right]. \quad (8)$$

$V(s_1) - V(s_2) \geq 0$ if

$$\frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1 - \nu_{h2}^1)^{k_1}} - \frac{\pi_h(\nu_{h2}^2)^{k_2}}{\pi_h(\nu_{h2}^2)^{k_2} + \pi_l(1 - \nu_{h2}^2)^{k_2}} \geq 0. \quad (9)$$

If we define $\theta = k_1 - k_2$ and $\tau = \nu_{h2}^1 - \nu_{h2}^2$, then we can rewrite the left hand side of equation 9 as

$$C(\tau, \theta) = \frac{\pi_h(\nu_{h2}^1)^{k_1}}{\pi_h(\nu_{h2}^1)^{k_1} + \pi_l(1 - \nu_{h2}^1)^{k_1}} - \frac{\pi_h(\nu_{h2}^1 - \tau)^{k_1 - \theta}}{\pi_h(\nu_{h2}^1 - \tau)^{k_1 - \theta} + \pi_l(1 - \nu_{h2}^1 + \tau)^{k_1 - \theta}}. \quad (10)$$

Note that $C(0, 0) = 0$. Totally differentiating equation 10 with respect to τ and θ we can thus find the set of τ and θ resulting in indifference between the two message services,

$$\frac{d\theta}{d\tau} = -\frac{(k_1 - \theta)\{2\pi_h(\nu_{h2}^1 - \tau)^{k_1 - \theta - 1} + \pi_l[(\nu_{h2}^1 - \tau)^{-1}(1 - \nu_{h2}^1 + \tau)^{k_1 - \theta} - (1 - \nu_{h2}^1 + \tau)^{k_1 - \theta - 1}]\}}{\pi_l(1 - \nu_{h2}^1 + \tau)^{k_1 - \theta}[\ln(\nu_{h2}^1 - \tau) - \ln(1 - \nu_{h2}^1 + \tau)]} \quad (11)$$

Additionally,

$$\frac{\partial C}{\partial \theta} = \frac{\pi_h \pi_l (\nu_{h2}^1 - \tau)^{k_1 - \theta} (1 - \nu_{h2}^1 + \tau)^{k_1 - \theta} [\ln(\nu_{h2}^1 - \tau) - \ln(1 - \nu_{h2}^1 + \tau)]}{[\pi_h (\nu_{h2}^1 - \tau)^{k_1 - \theta} + \pi_l (1 - \nu_{h2}^1 + \tau)^{k_1 - \theta}]^2}, \quad (12)$$

which will be negative if $\nu_{h2}^1 < \frac{1}{2}$.

Thus, equation 12 implies that $V(s_1) \geq V(s_2)$ will follow if

$$\frac{d\theta}{d\tau} < -(k_1 - \theta) \frac{2\pi_h(\nu_{h2}^1 - \tau)^{k_1 - \theta - 1} + \pi_l[(\nu_{h2}^1 - \tau)^{-1}(1 - \nu_{h2}^1 + \tau)^{k_1 - \theta} - (1 - \nu_{h2}^1 + \tau)^{k_1 - \theta - 1}]}{\pi_l(1 - \nu_{h2}^1 + \tau)^{k_1 - \theta}[\ln(\nu_{h2}^1 - \tau) - \ln(1 - \nu_{h2}^1 + \tau)]}. \quad (13)$$

Given equation 13 and using the implicit function theorem, it follows directly that:

$$\frac{\partial k(\pi_h - \nu)}{\partial \nu} < -(k_1 - \theta) \frac{2\pi_h(\nu_{h2}^1 - \tau)^{k_1 - \theta - 1} + \pi_l[(\nu_{h2}^1 - \tau)^{-1}(1 - \nu_{h2}^1 + \tau)^{k_1 - \theta} - (1 - \nu_{h2}^1 + \tau)^{k_1 - \theta - 1}]}{\pi_l(1 - \nu_{h2}^1 + \tau)^{k_1 - \theta}[\ln(\nu_{h2}^1 - \tau) - \ln(1 - \nu_{h2}^1 + \tau)]} \quad (14)$$

B.2 Proof of Proposition 2

Proposition 2: *Let s_1 and s_2 be two message services each with two possible messages: $\nu_{h1}^1 = \nu_{h1}^2 = \pi_h$, $\nu_{h2}^2 < \pi_h$, and $q_1^1 > q_2^1$. Then, message service 1 will be strongly preferred to message service 2.*

Using equation 5, let us consider $V(s_1) - V(s_2)$. $V(s_1) - V(s_2)$ can fall under two regimes.

I. If $\frac{\pi_h(\nu_{h2})^{k_2}}{\pi_h(\nu_{h2})^{k_2} + \pi_l(1-\nu_{h2})^{k_2}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) < U(\bar{\Pi})$, so that the individual does not invest when the disconfirming signal is received, then we have:

$$\begin{aligned} V(s_1) &= (1 - q_1^1) [U(\bar{\Pi}) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l)] \\ V(s_2) &= (1 - q_2^1) [U(\bar{\Pi}) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l)]. \end{aligned}$$

Thus,

$$V(s_1) - V(s_2) = (q_2^1 - q_1^1) [U(\bar{\Pi}) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l)] > 0. \quad (15)$$

II. If $\frac{\pi_h(\nu_{h2})^{k_2}}{\pi_h(\nu_{h2})^{k_2} + \pi_l(1-\nu_{h2})^{k_2}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) > U(\bar{\Pi})$, then we have:

$$\begin{aligned} V(s_1) &= (1 - q_1^1) \left[\frac{\pi_h(\nu_{h2})_1^k}{\pi_h(\nu_{h2})_1^k + \pi_l(1 - \nu_{h2})_1^k} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l) \right] \\ V(s_2) &= (1 - q_2^1) \left[\frac{\pi_h(\nu_{h2})_2^k}{\pi_h(\nu_{h2})_2^k + \pi_l(1 - \nu_{h2})_2^k} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l) \right]. \end{aligned}$$

Since $k \in [0, 1]$, we can say that:

$$\begin{aligned} V(s_1) - V(s_2) &= (q_2^1 - q_1^1) \left[\frac{\pi_h(\nu_{h2})^{k_2}}{\pi_h(\nu_{h2})^{k_2} + \pi_l(1 - \nu_{h2})^{k_2}} [U(\Pi_h) - U(\Pi_l)] + U(\Pi_l) - \pi_h U(\Pi_h) - \pi_l U(\Pi_l) \right] \\ &> 0. \quad (16) \end{aligned}$$

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