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# ACADEMY OF ACCOUNTING AND FINANCIAL STUDIES JOURNAL

## CONTENTS

# LETTER FROM THE EDITORS

Welcome to the *Academy of Accounting and Financial Studies Journal.* The editorial content of this journal is under the control of the Allied Academies, Inc., a non profit association of scholars whose purpose is to encourage and support the advancement and exchange of knowledge, understanding and teaching throughout the world. The mission of the *AAFSJ* is to publish theoretical and empirical research which can advance the literatures of accountancy and finance.

Dr. Mahmut Yardimcioglu, Karamanoglu Mehmetbey University, is the Editor. The mission is to make the *AAFSJ* better known and more widely read.

As has been the case with the previous issues of the *AAFSJ*, the articles contained in this volume have been double blind refereed. The acceptance rate for manuscripts in this issue, 25%, conforms to our editorial policies.

The Editor works to foster a supportive, mentoring effort on the part of the referees which will result in encouraging and supporting writers. He will continue to welcome different viewpoints because in differences we find learning; in differences we develop understanding; in differences we gain knowledge and in differences we develop the discipline into a more comprehensive, less esoteric, and dynamic metier.

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Mahmut Yardimcioglu, Karamanoglu Mehmetbey University

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# LETTER FROM ALLIED ACADEMIES

It is with the greatest sadness that we inform you of the death of Dr. Denise Woodbury in May, 2010. She has been a tremendous force in the Allied Academies organization and she has been a true friend of the Carlands for many years. She has been a member since 1997 and has served us in many ways. She will be truly missed; yet she leaves a wonderful legacy of caring and hope for all who knew her.

The Carlands have set up a scholarship for Denise through the Carland Foundation for Learning at their website at www.CarlandFoundation.org You are welcome to make a contribution in her memory at that site or to send a check to Carland Foundation for Learning to PO Box 914, Skyland, NC 28776.

Denise will be missed and long remembered by all.

Jim and JoAnn Carland
Trey and Shelby Carland
Jason Carland

# CPA LICENSING REQUIREMENTS

**Peter Aghimien, Indiana University South Bend**
**Dave Fred, Indiana University South Bend**

## ABSTRACT

*This paper examines the necessary requirements to becoming a Certified Public Accountant (CPA) in the fifty states of the United States of America and also the jurisdictions which include Guam, District of Columbia, Puerto Rico, Commonwealth of Northern Mariana Islands, and the Virgin Islands. Generally, there are four major requirements to become a CPA in the United States with each of the State Board of Accountancy and jurisdictions setting their own preferential requirements. The paper discusses the Education requirements and the minimum 150 semester hours rule to qualify for the CPA examination. This part also evaluate foreign educational requirements (individuals with education obtained outside the United States) to sit for the CPA exam. Additionally, the paper discusses the uniform CPA Exam, set by the American Institute of Certified Public Accountants (AICPA) including the major components and sections of the exam. Also, the paper evaluates the different Experience requirement which varies from state to state. What is more, the paper accesses the Ethics examination requirement as a test of an understanding of proper conducts in the accounting arena. Put them together – the four E's. Finally, the paper revisits the application process itself.*

## INTRODUCTION

Becoming a CPA is a long arduous process and while CPA's may not be as glamorous as attorneys, doctors or movie actors, their career can be equally rewarding (Johnston, 2007). Here is the arduous journey:

## EDUCATION REQUIREMENT

A majority of the states/jurisdictions require a minimum of one hundred and fifty semester hours of education (approved by the AICPA in 1988 requiring full execution from its members after the year 2000) from an accredited college or university as a prerequisite to CPA certification or their equivalent (state specific) (Raghunandan, Read, & Brown, 2005). This rule has inherently set additional college coursework comprising of general degree requirements of a bachelor's degree (presumably four years) plus additional specific credit hours. The 150-hour requirement has become necessary in order to prepare students for careers as CPA's, to expose students to a vast array of business issues, and also to maintain a new curriculum that addresses the new developments in the field of accounting and technology (Albrecht & Sack, 2006). The new developments include increases in official accounting and auditing pronouncements and the proliferation of new tax laws, and so on (Johnston, 2007).

There are a variety of ways to meet the education requirement. Here are some ways: A baccalaureate degree in accounting from a four-year college or university majoring in accounting accredited by the Association to Advance Collegiate Schools of Business International (AACSB). With the accounting education major, subjects must include an introductory to accounting courses, auditing, cost accounting, financial accounting, managerial accounting, and U.S. federal income tax (AICPA, 2006). The minimum semester hours in an accounting major (state specific) should be earned together with other business courses such as finance, economics, business administration, marketing, statistics and business law. Most states will accept the one hundred and fifty hour semester requirement by providing a Master of Business coursework. The rest may be earned through general education courses.

In some states the education requirement can also be satisfied with a non-business or non-accounting *undergraduate* degree combined with an MS in accounting or an MBA in accounting provided all the requisite (vital, mandatory) accounting and business coursework needed to take the CPA exam is met (AICPA, 2007).

**Candidates with accounting degrees from other Countries**

The academic credentials of applicants who have earned their degrees outside the United States (from foreign colleges and universities), must have their educational credentials evaluated for equivalency to U.S. standards. Some foreign credential service organization reviews credentials to determine whether they meet state specific educational requirements described above (Maryland Board of Accountancy, 2006).

**Implications of the 150-hour rule**

The one hundred and fifty semester hour rule qualifies a candidate to sit for the CPA Exam. Since the requirement is relatively new, some academia has examined the consequential possible costs and benefits. Some of the concerns about costs include:

- *Possible costs to students: - Imposition of another year of college study may make it financially difficult (especially economic hardship for minority students) to obtain their CPA licenses (Carroll, 2005).*

- *Possible costs to academic departments: - Additional resources in the form of classroom space, faculty, administrators and also acquiring a higher education standard can have a negative financial burden on institutions (Deppe, Hansen, & Jenne, 2005).*

*After satisfying the educational requirements, passing the CPA exams becomes the next hurdle.*

## EXAMINATION REQUIREMENT

In order to qualify for a licensure as a U.S. CPA, the candidate must sit for and pass the Uniform Certified Public Accountant examination in any of the fifty five jurisdictions. The uniform exam is set by the AICPA and is administered by the National Association of State Boards of Accountancy (NASBA). Here are the main reasons for the examination:

- *Taking and passing the exam is necessary (though not sufficient) condition for success as public accounting professional.*

- *The fact that public accounting profession relies on the CPA exam as a filter provides "a market validation" for using their performance on the CPA exam as an outcome measure (DeMog, et al. 2006).*

- *The CPA exam has traditionally been used as a measure of the quality of education received by student (Schick, 2005) hence passing the exam ensure a pool of quality accounting professionals ready to provide financial audit services, financial planning and analysis services, business consultation and advanced learning in colleges, and so on.*

The content specification and approximate percentages are illustrated in Table 1.

**Table 1: Content Specification of the Computerized Exam**

| Topic | | Weight |
|---|---|---|
| Auditing and Attestation (4.5 hrs) | Planning the engagement | 22-28% |
| | Internal control | 12-18% |
| | Documentation | 32-38% |
| | Review the engagement | 8-12% |
| | Prepare communication | 12-18% |

| Table 1: Content Specification of the Computerized Exam | | |
|---|---|---|
| Topic | | Weight |
| Financial Accounting and Reporting (4.0 hrs) | Concepts and standards | 17-23% |
| | Conformity with GAAP | 27-33% |
| | Specific types of transactions | 27-33% |
| | Accounting for governmental entities | 8-12% |
| | Accounting for not-for-profit organizations | 8-12% |
| Regulation (3.0 hrs) | Ethics and legal responsibilities | 15-20% |
| | Business law | 20-25% |
| | Federal taxation | 8-12% |
| | Federal taxation - property transactions | 8-12% |
| | Federal taxation - individuals | 12-18% |
| | Federal taxation - entities | 22-28% |
| Business Environment and Concepts (2.5 hrs) | Business structure | 17-23% |
| | Economic concepts | 8-12% |
| | Financial management | 17-23% |
| | Information technology | 22-28% |
| | Planning and measurement | 22-28% |

The exam is a fourteen hour computer-based and offered at specially authorized testing centers in each of the fifty five jurisdictions. The exam is available in English only and testing is offered up to five or six days a week, during two out of every three months period throughout the year (Philipp, 2007). The exam consists of three types of questions: multiple choice (four answer choices); objective questions or "other objective format" (questions that may involve matching, true-false, fill-in-the-blank, or numerical-answer questions); and essays. The only aids you are allowed to take to the examination tables are pens, pencils, and erasers (Smartpros, 2007). The exam is given in four parts which are:

- *Auditing and Attestation (AUD): This section tests an understanding of auditing standards and procedures, attest engagements, and the candidates ability to apply that understanding.*

- *Financial Accounting and Reporting (FAR): This part examines the, candidate's knowledge, awareness and understanding of Generally Accepted Accounting Principles as applicable to business enterprise, not-for-profit organizations, and government entities.*

- *Business Law and Professional Responsibility (REG): A candidate is tested on their understanding and knowledge of ethics, a CPA's professional and legal responsibilities, federal tax and the ability to apply this knowledge (AICPA, 2007).*

- *Business Environment and Concepts (BEC): This section examines a candidate's knowledge of the general business environment and business concepts needed to understand accounting implications of business transactions. This correlation is also tested in the candidate's ability to demonstrate and apply the knowledge (Roberts, 2006).*

Candidates can take one or more exam sections at a time. They cannot, however, take the same section more than once during any testing window (the quarterly period during which the exams are available). Generally, candidates have 18 months to pass all four sections and retain credit (AICPA, 2007). The passing grade in each of the sections is seventy five percent. Here is the passing percentage of candidates in each of the exam sections in 2008.

**Table 2: Uniform CPA Examination Passing Rates 2008**

| Section | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|
| AUD | 44.66% | 53.09% | 51.04% | 47.00% |
| BEC | 46.94% | 47.60% | 49.60% | 45.76% |
| FAR | 45.95% | 49.59% | 53.93% | 46.40% |
| REG | 45.66% | 48.57% | 51.15% | 48.59% |
| Quarter Cumulative Average | 45.80% | 49.71% | 51.43% | 46.94% |

The 2008 average cumulative passing percentage is 48.47%. The highest passing percentage seems to be in the third quarter in each of the sections and the lowest seems to be in the first quarter in each of the sections. This might be attributed to the fact that new candidates taking the exam for the first time prefer to take the exam in the first quarter hence lower passing percentage rate and then after gaining some insight and composure, they retake the exam in the third quarter.

## EXPERIENCE REQUIREMENT

This is one area of the licensure journey that is state specific. Each of the fifty five jurisdictions imposes a variety of different experience requirements. In 1992, the Uniform Accountancy Act (UAA) was developed by the AICPA and NASBA as a comprehensive model designed to promote *uniformity*, protect the public, and promote high professional standards which included encouraging the fifty five individual jurisdictions to adopt the Act mandating that "one year of experience in the practice of public accountancy or its equivalent, under the direction of a licensee meeting requirements prescribed by the Board by rule". From this notion, each of the separate jurisdictions would define the qualification of equivalent experience.

**An overview**

One jurisdiction does not require experience for certification (Puerto Rico) OF students with a baccalaureate majored in accounting, while others require full-time experience, continuous experience obtained immediately preceding the application or some require that a portion of the experience be gained in-state (Becker Review, 2007). In most jurisdictions, experience requirement is decreased for candidates with advanced education. For example jurisdictions such as Colorado and Massachusetts will waive the work experience requirement for those with a higher academic qualification compared to the state's requirement to appear for the uniform CPA (Titard, 2006). Experience can be categorized in the following forms:

- ♦ *Public Accounting Experience: This is vested in professional work experience obtained by providing people and businesses with a variety of specialized financial services including auditing, tax consulting and financial planning, environmental accounting, and other specialized assurance services. Also acceptable is teaching experience which, requires previous courses taught primarily in the accounting discipline for academic credit at an accredited four year college or university in at least two different areas of accounting above the introductory or elementary level and that part-time experience is permitted if it is continuous. In Connecticut for example, the experience requirement is three years full-time diversified experience involving the application of generally accepted accounting principles or the equivalent in government or industry.*

- ♦ *Non-public Accounting Experience: Certain jurisdictions accept non-public accounting experience (for a business, government or not-for-profit organization). For example in Georgia an applicant must file a Report of Practical Experience that documents that the applicant has a minimum of five years of experience in accounting-related activities verified and endorsed by a licensed CPA or an RPA who may be licensed in any state. In most jurisdictions, non-public experience is accepted when an individual has been under the supervision of a person licensed to practice public accounting and endorses the applicant provided the minimum state specific requirements in certain specific accounting fields are met. Other jurisdictions that will accept experience of a more general nature in accounting include Oregon, Virginia, Georgia and Kentucky*

**One-tier and Two-tier Requirements:**

With regards to the CPA exam and experience as a prerequisite to certification and licensing, there are two major applications:

**One-tier system**

Some jurisdictions have a one-tier structure for *certification* in which the candidate is required to pass the CPA examination and complete all necessary experience requirements before obtaining both the CPA certificate and license (AICPA, 2005). Concern has been raised that this might present an obstacle since the requirement is likely to exclude some otherwise qualified candidates from the profession (Schick, 2006).

**Two-tier system**

In a two-tier system, a candidate would first become certified as a CPA – usually by passing the CPA examinations, then after that a candidate must fulfill the experience requirements to obtain the license to practice public accounting (Schick, 2006). Some of the two-tiered jurisdictions include Illinois, Alabama and Montana.

Most states will accept a minimum number of hours (often forty hours annually) for appropriate continuing professional education (CPE) to maintain a CPA license. The CPA Certificate and Permit to Practice Requirement denote the State specific public or non-public accounting experience requirement as deemed acceptable by the state specific boards.

## ETHICS REQUIREMENT

In order to fulfill the requirements to obtaining a CPA license or certificate, some jurisdictions – currently over half of the states require the completion and passing of an ethics exam after passing the CPA exam. Part of the CPA examination, Regulation, consist of a section 'law and professional conduct' as an equivalent to the ethics exam. The AICPA also offers a Home Study Course in Professional Ethics which has been embraced by some states like Colorado, Connecticut, and South Dakota. The exam consists of fifty multiple-choice questions about different aspects concerning the practice and applicability of the AICPA code of professional conduct. Some of the topics covered include:

- *Analyzing the importance of independence and why you must be independent both in fact and in appearance,*
- *Listing of which restricted entities you must be independent of,*

- *Identifying the financial relationships between you and your clients that impair independence,*

- *Applying the provisions of the Code related to integrity, objectivity, due care, compliance with standards, and competence,*

- *Explaining why client information should be kept confidential,*

- *Assessing contingency fee issues related to certain tax matters, commissions, and referral fees,*

- *Identifying acts discreditable to the profession, particularly those related to the retention of client records,*

- *Applying the ethics rule relating to tax practice, advertising, form of organization, and firm name (Allen, CPA, 2007).*

A ninety percent in the ethics exam is considered a passing grade to be licensed and certified. These different topics are designed to achieve a high caliber in candidates who shall be well attuned to the concepts of moral and immoral conduct and also right and wrong applications in the professional accounting setting. Numerous corporate scandals e.g. Enron malpractices are a contributing factor to the public's cry for higher expectations to stiffening the laws governing the accounting profession.

Another school of thought has been to prioritize the testing of the ethics course during the uniform CPA examination as opposed to the separate AICPA ethics exam. The benefit as adduced, is that since every candidate is required to take the same CPA exams, this will achieve uniformity of ethical requirements in all jurisdictions.

## OTHER CONSIDERATIONS IN CPA LICENSING REQUIREMENTS

The above discussed four E's – Education, Exam, Experience and Ethics are a must for most of the jurisdictions to become a certified and licensed CPA. Some state specific requirements include:

### Reciprocity

This is a method by which a jurisdiction grants a CPA certificate to an individual who holds a CPA certificate in good standing in another jurisdiction as long as the candidate meets the certification and licensing requirements of the incumbent jurisdiction (Kay, 2006). There have been concerns raised about reciprocity in that temporary practice creates artificial barriers to the interstate practice and mobility of CPA's. This is particularly burdensome because many of the organizations requiring the services of CPA's transact business on both interstate and international basis and therefore practicing CPA extends beyond numerous jurisdictions let alone nations (McGarry, 2005).

**Age**

Some jurisdictions have a minimum age of eighteen years old and some twenty one years old depending on their state board requirement.

**Citizenship**

Only four jurisdictions namely: Hawaii, Alabama, Puerto Rico, and the Virgin Islands require candidates to be citizens of the jurisdiction. The rest accepts non-citizen applicants.

**In state residency (employment or Office)**

Most states do not require candidates to be employed and have an office in their states to qualify for CPA licensure and certification. Thirteen states require that a candidate be a resident, employed and have an office in the state to be qualified to practice CPA services.

**The Application Process**

After meeting the above state specific qualifications, most jurisdictions provide an online application form for practicing CPA. Most jurisdictions require the following information on the application form:

- *Completed and notarized application;*
- *Three (3) 2x2 photographs of applicant;*
- *Copy of Applicant's Social Security Card;*
- *A Favorable Tax Clearance Letter from the Internal Revenue Service;*
- *Applicant must meet the specified education and experience requirement;*
- *A certified copy of applicant's college transcript;*
- *A certified copy of applicant's CPA Certificate from another state (if applicable);*
- *Payment of Required Fees.*

## CONCLUSION

Satisfying the requirements of the four E's: *Education, Exam, Experience and Ethics* prior to CPA Licensure hopefully ensure that credible, candid and competitive individuals are the ones allowed to serve the growing demand for accounting services.

Since requirements differ somewhat from jurisdiction to jurisdiction, it is extremely important that prospective candidates contact and inquire from their respective State Board of Accountancy for information specific to the jurisdiction in question.

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| Table 3: Jurisdictions allowing candidates to sit at 120 hours (some require completion of baccalaureate as part of requirement to sit for exam), requiring 150 for licensure: 24 | |
|---|---|
| 1. | Alaska |
| 2. | Arizona |
| 3. | Connecticut |
| 4. | Delaware |
| 5. | Florida |
| 6. | Georgia |
| 7. | Hawaii |
| 8. | Idaho |
| 9. | Iowa |
| 10. | Kentucky |
| 11. | Maine |
| 12. | Massachusetts |
| 13. | Michigan |
| 14. | Minnesota |
| 15. | New Jersey |
| 16. | New York (150 for licensure takes effect Aug. 2009, candidates will still be allowed to sit at 120) |
| 17. | New Mexico |
| 18. | North Carolina |
| 19. | Pennsylvania |
| 20. | Rhode Island |
| 21. | South Carolina |
| 22. | Virginia |
| 23. | West Virginia |
| 24. | Guam |
| (Source: AICPA) | |

| Table 4: Jurisdictions allowing students to sit for exam prior to completion of education (with a defined time period to finish education), requiring 150 for licensure: 6 | |
|---|---|
| 1. | Missouri |
| 2. | North Dakota |
| 3. | South Dakota |
| 4. | Tennessee |
| 5. | Washington |
| 6. | Wisconsin |
| (Source: AICPA) | |

| Table 5: Jurisdictions that do not require 150 for licensure: 5 | |
|---|---|
| 1. | California |
| 2. | Colorado |
| 3. | New Hampshire |
| 4. | Vermont |
| 5. | Virgin Islands |
| (Source: AICPA) | |

| Table 6: Jurisdictions that require 150 to sit for exam and 150 for licensure: 20 | |
|---|---|
| 1. | Alabama |
| 2. | Arkansas |
| 3. | Commonwealth of Northern Mariana Islands |
| 4. | District of Columbia |
| 5. | Illinois |
| 6. | Indiana |
| 7. | Kansas |
| 8. | Louisiana |
| 9. | Maryland |
| 10. | Mississippi |
| 11 | Montana |
| 12. | Nebraska |
| 13. | Nevada |
| 14. | Ohio |

| Table 6: Jurisdictions that require 150 to sit for exam and 150 for licensure: 20 | |
|---|---|
| 15. | Oklahoma |
| 16. | Oregon |
| 17. | Puerto Rico |
| 18. | Texas |
| 19. | Utah |
| 20. | Wyoming |
| (Source: AICPA) | |

**Table 7: Jurisdictions That Have Passed the 150-hour Education Requirement**

| State | Enacted | Effective | | State | Enacted | Effective |
|---|---|---|---|---|---|---|
| Alabama | 1989 | 01/01/95 | | New York | 1998 | 08/01/09 |
| Alaska | 1991 | 01/01/01 | | North Carolina | 1997 | 01/01/01 |
| Arizona | 1999 | 06/30/04 | | North Dakota | 1993 | 01/01/00 |
| Arkansas | 1990 | 01/01/98 | | Ohio | 1992 | 01/01/00 |
| Commonwealth of Northern Marianas | 2003 | 05/20/03 | | Oklahoma | 1998 | 07/01/03 |
| | | | | Oregon | 1997 | 01/01/00 |
| Connecticut | 1992 | 01/01/00 | | Pennsylvania* | 2008 | 01/01/12 |
| District of Columbia | 1995 | 01/02/00 | | Puerto Rico | 1994 | 01/01/00 |
| Delaware | 2008 | 08/01/12 | | Rhode Island | 1992 | 07/01/99 |
| Florida | 1979 | 08/01/83 | | South Carolina | 1991 | 07/01/97 |
| Georgia | 1991 | 01/01/98 | | South Dakota | 1992 | 01/01/98 |
| Guam | 1994 | 06/01/00 | | Tennessee | 1987 | 04/14/93 |
| Hawaii | 1997 | 12/31/00 | | Texas | 1989 | 08/31/97 |
| Idaho | 1993 | 07/01/00 | | Utah | 1981 | 07/01/94 |
| Illinois | 1991 | 01/01/01 | | Virginia | 1999 | 07/01/06 |
| Indiana | 1992 | 01/01/00 | | Washington | 1995 | 07/01/00 |
| Iowa | 1992 | 01/01/01 | | West Virginia | 1989 | 02/15/00 |
| Kansas | 1990 | 06/30/97 | | Wisconsin | 1996 | 01/01/01 |
| Kentucky | 1990 | 01/01/00 | | Wyoming | 1993 | 01/01/00 |
| Louisiana | 1990 | 12/31/96 | | Currently in Effect | | 47 |
| Maine | 1997 | 10/02/02 | | Effective at a Future Date | | 3 |

| Table 7: Jurisdictions That Have Passed the 150-hour Education Requirement | | | | | | |
|---|---|---|---|---|---|---|
| State | Enacted | Effective | | State | Enacted | Effective |
| Maryland | 1993 | 07/01/99 | | TOTAL | | 50 |
| Massachusetts | 1998 | 07/01/02 | | | | |
| Michigan | 1998 | 07/01/03 | · | *Currently five jurisdictions do NOT have the 150 hour requirement in place: California, Colorado, New Hampshire, Vermont and the Virgin Islands.* | | |
| Minnesota | 2000 | 07/01/06 | | | | |
| Mississippi | 1990 | 02/01/95 | · | *24 jurisdictions allow candidates to sit at 120 hrs, but require 150 for certification. They are: AK, AZ, CT,DE, FL, GA, HI, ID, IA, KY, MA, ME, MI, MN, NC, , NJ, NM, NY, PA, RI, SC, VA, WV, Guam* | | |
| Missouri | 1993 | 06/30/99 | | | | |
| Montana | 1989 | 07/01/97 | | | | |
| Nebraska | 1991 | 01/01/98 | · | *Note: PA is still an optional 150 state, but legislation passed in 2008 will require 150 hours for licensure beginning in 2012.* | | |
| Nevada | 1993 | 01/01/01 | | | | |
| New Jersey | 1995 | 07/02/00 | · | *6 jurisdictions allow students to sit for the exam prior to completion of the 150 hours, but set a time limit to finish the 150 requirement for licensure: MO, ND, SD, TN, WA, WI* | | |
| New Mexico | 1999 | 07/01/04 | | | | |
| Source: AICPA 2008) | | | | | | |

# PAY VERSUS PERFORMANCE IN TARP RECIPIENT FIRMS

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## ABSTRACT

*Short-term incentives and excessive risk-taking that stem from executive compensation policies have contributed to the current financial crises which began in 2007 with the Bear Stearns financial woes (Kropp, 2009; Sloan, 2009). The U.S. government has been proactive in creating a stimulus package of unprecedented proportions, and as of June, 2009 there were 613 companies participating in the Troubled Asset Relief Program (TARP). The purpose of this paper is to analyze top TARP recipient firms to test whether compensation in these stressed companies is associated with performance measures. The prediction is that these companies will exhibit an increasing relationship between pay and performance from 2006 to 2008.*

*Results indicate that performance measures are not significantly associated with Chief Executive Officer (CEO) compensation in 2006, but in 2007 stock returns, EPS, and return on equity are significantly associated with CEO total compensation. This implies that pay is linked with performance in 2007, which coincides with the SEC's enhanced executive compensation disclosure requirements. In 2008, several performance measures are significantly associated with total CEO compensation, but unpredicted negative coefficients confirm prior research that earnings-related fundamentals are not useful in explaining compensation in loss years (Jackson, Lopez & Reitenga, 2008), even for these companies regulated by TARP.*


## INTRODUCTION

There has been much discussion in the business press about executive compensation and its alignment to performance and risk-taking, especially since many U.S. companies have received bailout funds from taxpayers (Benjamin & Goldman, 2009). It is widely believed that short-term incentives which stem from executive compensation policies have contributed to the current financial crisis, which began in June, 2007 with the meltdown of two Bear Stearns' hedge funds that speculated in mortgage-backed securities (Sloan 2009; Kropp, 2009). Numerous legislative packages passed by the U. S. Congress in a relatively short period of time have brought unprecedented amounts of bailout money to troubled U.S. companies. Included in the stimulus package totaling $12.2 trillion is the Troubled Asset Relief Program (TARP) which commits up to $700 billion for investment in companies in exchange for preferred stock which is held by the U.S. Treasury.

Agency theory states that management should act in the interest of stakeholders, but according to Arthur Levitt (2005), America has seen the" breakdown of corporate governance and buildup in greed" which has compromised the fiduciary relationship between management and stakeholders. Huge executive pay "undermines corporate governance," since management becomes focused on short-term goals rather than the long-term interest of stakeholders (Levitt, 2005). Dating back to Enron's bankruptcy, we have seen Chief Executive Officers (CEO's) walk away with millions, leaving behind shareholders, debt holders, and employee retirement funds in shambles. In response, we now have an increased number of shareholder proposals, new disclosure rules from the SEC (2006) and enhanced limits on executive compensation under TARP, all reflecting the general public's interest in the pay versus performance debate.

The purpose of this paper is to analyze top TARP recipients in order to test whether CEO compensation in these troubled companies is associated with performance measures during the period from 2006 through 2008. I extend prior executive compensation research to analyze total compensation in stressed companies. I test to see whether recent SEC executive compensation disclosure rules and the stringent limits of executive compensation under TARP have increased the relationship between pay and performance. Results indicate that performance measures are not significantly associated with CEO compensation in 2006, but in 2007 stock returns, EPS, and return on equity are significantly associated with CEO total compensation. This implies that pay is linked with performance in 2007, which coincides with the SEC's enhanced executive compensation disclosure requirements. In 2008 several performance measures are significantly associated with total CEO compensation, but negative coefficients confirm prior research that earnings-related fundamentals are not useful in explaining compensation in loss years (Jackson, Lopez & Reitenga, 2008), even for these companies regulated by TARP.

This paper is organized as follows. The next sections provide background and hypothesis development. Next are the sample and model descriptions, followed by analysis of results. Finally, conclusions are presented.

## BACKGROUND

The SEC has alternated between tabular and narrative formats since the first disclosure was required in 1938 and the first tabular disclosure in 1942 (Donahue, 2008). Disclosure was extended to cover all forms of executive packages in 1978, and the format moved away from the tabular disclosure to a more narrative style in 1983. In 1992, requirements returned to predominantly tabular format, and finally in 2006, the rules broadened both the tabular and narrative requirements. The 2006 rules require a thorough Compensation Discussion and Analysis (CD&A) which must be certified under Sarbanes-Oxley. The intent is to better disclose the new types of executive compensation. A summary table of 10 columns is required and must now show total compensation in dollars for the first time, with stock no longer in units. Included are compensation for the current and prior two years, equity compensation and retirement and other post employment compensation.

This information is required for the Principal Executive Officer, the Principle Financial Officer, and the next three highest paid executive officers (SEC, 2006).

Narratives must be written in "Plain English" which requires "clear, concise sections, paragraphs and sentences," in active voice with concrete everyday words (SEC, 2006). The purpose of the CD&A is to give an overview of the compensation policies and decisions. In addition firms must disclose information about compensation consultants and other resources used by the committee in setting compensation levels. The SEC issued a report after analyzing the first two years of submissions under the new rules and found firms lacking information about how they arrived at compensation policy and how their committees used individual performance to set compensation (White, 2009). Since disclosure requirements are principles-based, each firm decides which parts of the compensation policy merit disclosure. However, firms must disclose performance targets or show that disclosure will cause "competitive harm" (SEC, 2006). If benchmarks are used in setting compensation, the firm should identify the benchmark and its components if applicable. Executive compensation has risen exponentially over the years. In the 1950s executive pay was about $1.3M in 2008 dollars, with big increases between 1980-2000, from $3.7 million to $17.4 million. Also, there were big increases between 1993 and 2000, with slight decreases in 2001 due to poor stock performance (Anson, White, McGrew & Butler, 2004). CEO compensation has risen from 100 times the average worker in 1980 to 400 times in 2000, although part of this increase comes from adding the value of pensions to the compensation package. Also, the use of stock options in pay packages has brought executive compensation to much higher levels (Schooley, 2005).

TARP is part of the $12.2 billion government bailout. Included in the $700 billion allocated to TARP are $100 billion to the Term Asset-Backed Securities Loan Facility (TALF) and $100 billion to the Public-Private Investment Fund. TALF provides loans and accepts securities backed by consumer and small business loans, and the Public-Private Investment Fund buys nonperforming assets from banks. Of the $500 billion remaining, $428.3 billion had been committed to 613 U.S. companies as of June 5, 2009, and $50 billion had been committed to private investors for foreclosure relief. As of February, 2009 firms had paid $2.5 billion in dividends to the government (ProPublica, 2009; New York Times, 2009).

When TARP was established under the Emergency Economic Stabilization Act (EESA) in October, 2008, guidelines were set for executive compensation. These guidelines were revised in their entirety by the American Recovery and Reinvestment Act of 2009 (ARRA). Some of the key points of ARRA (2009) are the following:

- *No golden parachute payments are allowed.*
- *Bonuses, retention awards and incentive compensation are not allowed, except for long-term restricted stock if it does not exceed one-third of the annual compensation and if it does not fully vest while TARP funds are owed to the government.*

- *Compensation plans are not allowed if they encourage manipulation of earnings to enhance employee compensation.*
- *Specified luxury expenses are limited.*
- *There is a "clawback" clause where employees may be asked for reimbursements if payments were inconsistent with TARP or contrary to the public interest.*
- *Shareholders must be permitted to vote on executive compensation, although the result of the vote is nonbinding.*

## HYPOTHESIS DEVELOPMENT

Excessive executive pay undermines corporate governance, since management becomes focused on short term goals rather than the long term interest of the stockholders (Levitt, 2005). Interlocking directors and the fraternal nature of boards result in compensation committees' approving huge salaries, particularly since it is often the case that highly paid CEO's sit on the compensation committees of other CEOs (Friedland, 2004; Strier, 2007). The NYSE and NASDAQ now require nominating and compensation committee members to be composed of independent directors, but this does not address the issue of interlocking directors. Pay should be aligned with long term goals and performance.

Prior research finds a positive relationship between contemporaneous earnings and CEO compensation (Lambert & Larcker, 1987; Sloan, 1993; Baber, Kang & Kumar, 1999) except when earnings are poor and declining (Gaver & Gaver, 1998). Thus, executive compensation is weakly linked to performance. Accounting fundamentals explain CEO bonuses, but earnings do not explain bonuses if there are negative or declining earnings (Jackson, Lopez & Reitenga, 2008). Compensation committees focus on accounting fundamentals rather than earnings when earnings are negative or declining (Jackson, Lopez & Reitenga, 2008).

Several studies present investigations of different accounting and economic variables that are associated with compensation. Anson, White, McGrew & Butler (2004) suggest nine metrics to measure performance, and Core (1999) lists economic determinants of compensation. Nourayi (2008) examines CEO compensation by looking at size, ROA and total one year stock return in a sample partitioned by CEO tenure, and finds that firm size is the most significant factor. Similarly, Nourayi and Daroca (2008) find that firm size and market-based return are the most significant explanatory variables affecting executive compensation. Less significant are accounting based measures and number of employees.

The purpose of this study is to investigate the pay for performance issue in firms that are recipients of TARP funds. Since these firms are operating under the stringent executive compensation rules in TARP as well as enhanced disclosure for executive compensation required by the SEC since December, 2006, my hypothesis is that these firms will exhibit an increasing relationship between pay and performance from 2006 through 2008.

## SAMPLE

The sample for this paper is drawn from the top TARP fund recipients that are listed on the ProPublica (2009) website and that have proxies available on the SEC website for 2006 through 2008. There are 142 companies that received $50 million or greater in TARP funds as of June 5, 2009, and of these there are thirty firms that do not have proxies available on the SEC website. Thus, the total sample size is 112 firms.

Table 1 shows a summary of the sample firms by industry and the amount of TARP bailout funds they received, along with CEO compensation details for firms receiving larger amounts of TARP funds. Table 1 also shows a reconciliation to the $700 billion TARP funds that were approved by Congress in October, 2008. As companies are paying back these funds and as funds are issued under the TALP, Public-Private Investment Fund and foreclosure relief programs that are part of TARP, the amount outstanding changes daily. For current information see the ProPublica website at http://www.bailout/propublica.org.

**Table 1: Firms by Industry and TARP Reconciliation**

| | | Total Compensation (thousands) | | | TARP |
|---|---|---|---|---|---|
| Firms by Industry | N | 2006 | 2007 | 2008 | Funds |
| Mortgage Servicer | | | | | (millions) |
| Ocwen Financial Corporation | 1 | 1,215 | 2,492 | 2,273 | 659 |
| Insurance Company | | | | | |
| AIG | 4 | 21,229 | 14,330 | 29,692 | 69,835 |
| Hartford Financial Services | | 18,211 | 15,831 | 4,470 | 3,400 |
| Lincoln National Corporation | | 5,208 | 18,000 | 7,325 | 2,500 |
| Principal Financial Group | | 4,506 | 5,313 | 41,639 | 2,000 |
| Total | | | | | 77,735 |
| Financial Services Company | | | | | |
| American Express | 2 | 29,137 | 26,082 | 27,327 | 3,389 |
| Discover Financial Services[1] | | | 8,003 | 8,298 | 1,225 |
| Total | | | | | 4,613 |
| Bank | | | | | |
| Bank of America | 104 | 27,873 | 24,844 | 9,959 | 52,500 |
| Citigroup | | 25,975 | 23,833 | 10,815 | 50,000 |
| JPMorgan Chase | | 39,053 | 27,797 | 19,651 | 25,000 |
| Wells Fargo | | 29,846 | 12,568 | 13,782 | 25,000 |

| Table 1: Firms by Industry and TARP Reconciliation | | | | | |
|---|---|---|---|---|---|
| | | Total Compensation (thousands) | | | TARP |
| Firms by Industry | N | 2006 | 2007 | 2008 | Funds |
| Goldman Sachs[1] | | | 70,324 | 1,113 | 10,000 |
| Morgan Stanley[1] | | | 1,602 | 1,235 | 10,000 |
| All other banks (98) | | | | | 66,031 |
| Total | | | | | 238,531 |
| Auto Company | | | | | |
| General Motors | 1 | 10,191 | 14,415 | 14,415 | 50,745 |
| Total sample firms | 112 | | | | 372,283 |
| Other TARP recipient firms | 501 | | | | 55,985 |
| Total TARP recipient firms | 613 | | | | 428,268 |
| Other programs under TARP: | | | | | |
| TALP | | | | | 100,000 |
| Public-Private Investment Fund | | | | | 100,000 |
| Private foreclosure relief | | | | | 50,000 |
| Other/uncommitted | | | | | 21,732 |
| Total TARP funds | | | | | 700,000 |

[1]Total compensation not available in 2006 proxies.
data sources: http://www.probublica.org as of June 5, 2009 and proxy statement from http://www.sec.gov

Table 2 shows descriptive statistics for the 112 firms in the sample. The changes from 2006 to 2008 are indicative of the financial crisis that was developing. The one-year stock returns are decreasing, as are ROA, EPS, sales, return on invested capital, ROE, and sales growth. Average total compensation for the sample firms is decreasing from 2006 to 2007 (4.3%) and then decreases dramatically (22.5%) from 2007 to 2008.

| Table 2: Descriptive Statistics | | | | | | |
|---|---|---|---|---|---|---|
| Variable | Year | N | Mean | Dev | Minimum | Maximum |
| 1yrret | 2006 | 110 | 13.876 | 16.135 | -21.123 | 82.299 |
| 1yrret | 2007 | 111 | -25.206 | 18.407 | -65.069 | 28.147 |
| 1yrret | 2008 | 112 | -29.528 | 36.288 | -97.094 | 65.704 |
| Roa | 2006 | 112 | 1.221 | 1.006 | -1.062 | 10.275 |

**Table 2: Descriptive Statistics**

| | | | | | | |
|---|---|---|---|---|---|---|
| Roa | 2007 | 112 | 0.593 | 2.872 | -29.081 | 2.702 |
| Roa | 2008 | 111 | -0.768 | 3.708 | -33.895 | 2.664 |
| Assets | 2006 | 112 | 101,659.640 | 299,152.440 | 476.299 | 884,318.000 |
| Assets | 2007 | 112 | 15,146.010 | 342,395.910 | 563.828 | 2,187,631.000 |
| Assets | 2008 | 111 | 121,007.650 | 361,912.530 | 2,002.340 | 2,175,052.000 |
| Clprice | 2006 | 111 | 39.126 | 24.944 | 9.530 | 194.800 |
| Clprice | 2007 | 112 | 29.412 | 25.754 | 5.540 | 226.640 |
| Clprice | 2008 | 112 | 18.172 | 14.160 | 0.710 | 78.990 |
| Epsx | 2006 | 112 | 2.604 | 2.526 | -3.500 | 20.930 |
| Epsx | 2007 | 112 | 1.386 | 7.929 | -76.520 | 26.340 |
| Epsx | 2008 | 111 | -1.576 | 7.061 | -53.320 | 5.040 |
| Sales | 2006 | 112 | 10,162.620 | 30,806.550 | 33.419 | 207,349.000 |
| Sales | 2007 | 112 | 10,730.390 | 30,972.240 | 41.643 | 181,122.000 |
| Sales | 2008 | 111 | 8,154.390 | 23,589.310 | 51.157 | 148,979.000 |
| Retoninv | 2006 | 104 | 9.698 | 3.833 | -1.536 | 21.291 |
| Retoninv | 2007 | 106 | 4.940 | 21.549 | -210.865 | 20.117 |
| Retoninv | 2008 | 107 | -3.338 | 13.448 | -44.900 | 14.580 |
| Roe | 2006 | 111 | 13.208 | 5.377 | 1.810 | 37.010 |
| Roe | 2007 | 111 | 9.565 | 6.201 | -8.180 | 36.703 |
| Roe | 2008 | 110 | -8.532 | 29.481 | -189.199 | 24.246 |
| Cshares | 2006 | 112 | 302.767 | 812.163 | 0.001 | 4,911.990 |
| Cshares | 2007 | 112 | 310.139 | 808.938 | 6.168 | 4,994.580 |
| Cshares | 2008 | 111 | 343.893 | 912.552 | 6.159 | 5,450.070 |
| Divxdate | 2006 | 111 | 0.828 | 0.606 | 0.000 | 3.690 |
| Divxdate | 2007 | 112 | 0.883 | 0.658 | 0.000 | 3.730 |
| Divxdate | 2008 | 112 | 0.800 | 0.658 | 0.000 | 3.770 |
| Salegr | 2006 | 112 | 25.618 | 18.536 | -2.152 | 142.707 |
| Salegr | 2007 | 112 | 13.149 | 14.930 | -36.689 | 66.133 |
| Salegr | 2008 | 111 | -7.124 | 16.458 | -89.795 | 38.197 |
| Totalcomp | 2006 | 104 | 5,001,756.09 | 8,241,281.32 | 143,851.00 | 39,053,329.00 |
| Totalcomp | 2007 | 111 | 4,788,699.63 | 9,016,669.45 | 309,196.00 | 70,324,352.00 |
| Totalcomp | 2008 | 109 | 3,712,229.89 | 5,675,970.85 | 299,354.00 | 29,692,048.00 |
| bailoutK | | 112 | 3,323,956.90 | 10,893,245.91 | 50,000.00 | 69,835,000.00 |

**Table 2: Descriptive Statistics**

Variable Definitions (Compustat Mnemonics in parentheses):

1yrret = one year total return (TRT1Y)
Roa = return on assets (ROA)
Assets = total assets in millions (AT)
Clprice = closing price (PRCCF)
Epsx = Earnings per share excluding extraordinary items (EPSPX)
Sales = net sales in millions (sale)
Retoninv = return on invested capital (ROAI)
Roe = return on equity (ROE)
Cshares = common shares (CSHO)
Divxdate = dividends per share for which ex-dividend dates occurred during the reporting period (DVPSX)
Salegr = sales percentage change for one year (SALECHG1)
Totalcomp = Total CEO compensation in dollars (from SEC proxies)
BailoutK = bailout funds in thousands

## MODEL

Following the second anniversary of the 2006 executive compensation disclosure rules, the SEC reviewed the executive compensation disclosures to date and suggested some measures which were deemed appropriate for setting CEO compensation levels. The measures recommended by the SEC are EPS, EBITDA, growth in net sales, and growth in market share. Pursuant to prior research, the SEC's suggestions and a cursory review of selected CD&A from my sample, I use the following model and variables to test the degree to which the CEO compensation is associated with both accounting and market performance measures for 2006, 2007, and 2008 separately. I predict that as CEO compensation declines over this time period, there will be increased significance of the performance measures in relation to CEO compensation. To test this prediction, the following model from Nourayi (2008) is adapted to include the performance measures listed below:

$$Total\ compensation = \beta_0 + \beta_1\ size + \beta_2\ performance + \epsilon \qquad (1)$$

where performance variables are the following (Compustat Mnemonics in parentheses):

Total compensation = Total CEO compensation in millions (from SEC proxies)
Size = natural log of assets (AT)

Performance variables:

One year total stock return (TRT1Y)
Return on assets (ROA)
Earnings per share excluding extraordinary items (EPSPX)
Return on invested capital (ROAI)
Return on equity (ROE)
One year sales growth (SALECHG1)

Consistent with prior research, I find the accounting and market performance variables to be significantly correlated (not displayed) for 2006-2008. Thus, I test separately each of the performance variables in the multivariate analysis in order to avoid multicollinearity (Tables 3-5).

## RESULTS

Tables 3-5 display the results of the separate Ordinary Least Squares (OLS) regressions for each of the sample years, 2006-2008. Table 3 shows that none of the performance variables are significantly associated with total CEO compensation in 2006, supporting the lack of a pay for performance model.

| **Table 3: 2006 Regressions of CEO total compensation on size and performance fundamentals Coefficients (p-values)** | | | | | | |
|---|---|---|---|---|---|---|
| *Total compensation* = $\beta_0 + \beta_1$ *size* + $\beta_2$ *performance* + $\epsilon$ | | | | | | |
| Intercept | -28.578 | -29.353 | -27.319 | -30.837 | -29.791 | 29.28 |
| | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) |
| size06 | 3.566 | 3.568 | 3.338 | 3.735 | 3.522 | 3.606 |
| | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) |
| 1yrret06 | 0.011 | | | | | |
| | -0.7402 | | | | | |
| Roa06 | | 0.748 | | | | |
| | | -0.1325 | | | | |
| EPSX06 | | | 0.433 | | | |
| | | | -0.1839 | | | |
| Retoninv06 | | | | 0.104 | | |
| | | | | -0.4812 | | |
| ROE06 | | | | | 0.141 | |
| | | | | | -0.1541 | |

| Table 3: 2006 Regressions of CEO total compensation on size and performance fundamentals<br>Coefficients (p-values) | | | | | | |
|---|---|---|---|---|---|---|
| *Total compensation = $\beta_0 + \beta_1$ size + $\beta_2$ performance + $\epsilon$* | | | | | | |
| Salegr06 | | | | | | 0.019 |
| | | | | | | -0.4913 |
| Adj R2 | 0.6129 | 0.6223 | 0.6204 | 0.6328 | 0.6232 | 0.6155 |
| N | 103 | 104 | 104 | 96 | 103 | 104 |
| See Table 2 for variable definitions. | | | | | | |

Table 4 demonstrates that as CEO pay is declining, the one year stock return, EPS and ROE are significantly associated with CEO pay, indicating that pay is more closely aligned with performance in these firms for 2007. The TARP rules are not in effect until the end of 2008, but 2007 is the first year the SEC revised disclosure rules are in effect (effective December, 2006), thus requiring increased transparency through enhanced tabular and narrative disclosure, It is interesting to note that the decrease in CEO pay in 2007 coincides with the effective date of the 2006 enhanced disclosure rules for executive compensation.

| Table 4: 2007 Regressions of CEO total compensation on size and performance fundamentals<br>Coefficients (p-values) | | | | | | |
|---|---|---|---|---|---|---|
| *Total compensation = $\beta_0 + \beta_1$ size + $\beta_2$ performance + $\epsilon$* | | | | | | |
| Intercept | -22.745 | -27.55 | -27.463 | -28.689 | -29.154 | -29.525 |
| | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) |
| size06 | 3.149 | 3.398 | 3.366 | 3.514 | 3.192 | 3.475 |
| | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) |
| 1yrret06 | 0.096 | | | | | |
| | -0.0051 | | | | | |
| Roa06 | | 0.0245 | | | | |
| | | -0.9086 | | | | |
| EPSX06 | | | 0.076 | | | |
| | | | -0.0312 | | | |
| Retoninv06 | | | | 0.0025 | | |
| | | | | -0.9329 | | |
| ROE06 | | | | | 0.372 | |
| | | | | | -0.0002 | |

| Table 4: 2007 Regressions of CEO total compensation on size and performance fundamentals Coefficients (p-values) | | | | | | |
|---|---|---|---|---|---|---|
| *Total compensation* = $\beta_0$ + $\beta_1$ *size* + $\beta_2$ *performance* + $\epsilon$ | | | | | | |
| Salegr06 | | | | | | 0.094 |
| | | | | | | -0.0242 |
| Adj R2 | 0.5183 | 0.4823 | 0.5041 | 0.4962 | 0.5424 | 0.5061 |
| N | 110 | 111 | 111 | 106 | 110 | 111 |
| See Table 2 for variable definitions. | | | | | | |

Table 5 shows results for tests of 2008 performance variables, with ROA, EPS and ROE all significant. However, contrary to predictions, the signs are negative, indicating that these earnings-related variables are not useful in explaining compensation in loss years, as prior research has determined (Jackson, Lopez & Reitenga, 2008). This time period coincides with the deepening of the economic crisis that began in 2006 and as noted in Table 2, most performance measures are declining. In spite of the increased scrutiny from the SEC and the imposition of TARP regulation on executive compensation, CEO pay does not reflect performance in 2008.

| Table 5: 2008 Regressions of CEO total compensation on size and performance fundamentals Coefficients (p-values) | | | | | | |
|---|---|---|---|---|---|---|
| *Total compensation* = $\beta_0$ + $\beta_1$ *size* + $\beta_2$ *performance* + $\epsilon$ | | | | | | |
| Intercept | -15.57138 | -15.671 | -15.456 | -16.136 | -15.737 | -15.904 |
| | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) |
| size06 | 1.972 | 1.995 | 1.965 | 2.055 | 1.991 | 2.036 |
| | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) | (<.0001) |
| 1yrret06 | -0.012 | | | | | |
| | -0.349 | | | | | |
| Roa06 | | -0.272 | | | | |
| | | -0.0139 | | | | |
| EPSX06 | | | 0.056 | | | |
| | | | -0.0016 | | | |
| Retoninv06 | | | | -0.03 | | |
| | | | | -0.3273 | | |
| ROE06 | | | | | -0.03 | |
| | | | | | -0.0328 | |

| Table 5: 2008 Regressions of CEO total compensation on size and performance fundamentals<br>Coefficients (p-values) | | | | | | |
|---|---|---|---|---|---|---|
| Salegr06 | | | | | | -0.006 |
| | | | | | | -0.8145 |
| Adj R2 | 0.4336 | 0.4609 | 0.4807 | 0.4391 | 0.449 | 0.4291 |
| N | 108 | 108 | 108 | 104 | 107 | 108 |
| See Table 2 for variable definitions. | | | | | | |

## CONCLUSIONS

In summary, the pay for performance predicted for TARP recipient firms is partially supported, but only for 2007, which coincides with effective date of the SEC enhanced disclosure laws. None of the performance variables significantly explain CEO compensation in 2006. The one year stock return, EPS, and return on invested capital are significant variables in 2008, but the signs are not positive as expected. This confirms prior research findings that earnings-based performance measures are not useful in explaining compensation in loss years (Jackson, Lopez & Reitenga, 2008). Future research should track these firms as the executive compensation limits expire upon repayment of TARP funds.

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# EVIDENCE OF R&D EFFECTS ON CROSS SECTIONAL STOCK RETURNS

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## ABSTRACT

*This article provides evidence on the effects of R&D expenditures on firms' subsequent stock returns. Results show that R&D expenditures scaled by firms' market value and total assets are significantly associated with their subsequent returns when other fundamental variables (market return, firm's market value and price to book ratio) are accounted for. Such effects are larger for the upper quintile R&D expenditure firms (those with higher R&D investments) than to total sample firms. Evidence also shows that R&D expenditures affect firms' returns up to the third year following the R&D investment.*

## INTRODUCTION

There exist numerous studies exploring the topic of economic, market, or firm specific factors affecting stock returns. For example, the pioneering work of the Sharp-Lintner asset-pricing model (Sharpe 1964 & Lintner 1965) shows that expected returns on securities are a positive linear function of their market βs, which can describe cross sectional expected returns. Market risk measurement (β) is not the only variable to draw attention from researchers; other variables such as firm size and leverage also draw researchers' interests due to their ability to capture stock risks and explain variability of returns. Banz (1981)found that average returns on small size stocks are too high based on their β estimates while average returns on large size stocks are too low. Bhandari (1988) proposes that leverage helps explain the cross section of average stock returns in a test that includes size as well as β. Fama and French (1992) confirmed that size and book-to-market ratio could capture the cross-sectional stock returns together with β, leverage, and earnings-price ratios. It is interesting that in this study, market b seems to have no role in explaining average returns, while size and book-to-market equity capture cross-sectional variation in average stock returns.

While the book to market phenomena are well accepted among researchers, Lev and Sougiannis (1999) examine book to market ratio effects as explained by R&D investment. These authors argue that R&D capital as an innovative effort will affect subsequent stock returns. The argument is that a firm's market value differs from its book value by the present value of their future abnormal earnings, and that future abnormal earnings are the result of either monopoly power or innovation. Innovation, as expressed by R&D, could at least to some extent explain the relationship between book to market value and subsequent stock returns. Lev & Sougiannis's study penetrates the book to market effect, finding that its explanatory power becomes weak when in the presence of the R&D capital-to-market variable. In addition, these authors conclude that for firms engaged in R&D, R&D has impact on subsequent stock returns.

The proposition that R&D expenditures are intangible investments and contribute to firms' future operating performances has also been examined among researchers. Most studies confirm that R&D is associated with improvement in firms' operating performances (e.g., Eberhart, Maxwell and Siddique, 2004; Anagnostopoulou and Levis, 2008). Jain and Kini (2007) studied the effect of R&D investments on IPOs. This study is inconclusive in that a consistent relationship was demonstrated between R&D expenditures and a change in operating performance after the IPO. However, Jain and Kini provide evidence that R&D spending impacts IPO firms' ability to remain viable for a longer period of time. This study also shows that high R&D activity helps maintain the interest of the investment community and consequently its willingness to supply additional capital, regardless of initial profitability.

Other current research examining R&D effects mainly focuses on firms' market value instead of operating performances or stock returns. For example, Bosworth (2001) investigated how R&D and intellectual property activities influence the market value of firms and found that R&D and patent activity are positively and significantly associated with market value. Hall (1993) investigated the stock market's valuation of R&D investment during the 1980's, finding that R&D could explain a fair amount of the variance of market value after controlling for firm size.

Previous research brings to question how the market reacts to R&D investments, if R&D is an innovation and an intangible, yet viable input. Our study is designed to show evidence of the effect of a firm's R&D expenses on its subsequent stock returns. To be consistent with previous studies, we test how much R&D capital expenditure explains cross sectional stock returns while controlling for risk factors such as firm size and book to price ratio. One unique feature of this study is that we have examined firm's three year buy and hold returns following R&D investments. This is distinct from the one year returns in Lev and Sougiannis 1999, and monthly returns in Eberhart, Maxwell, and Siddique(2004). Our results are supportive of the proposition that R&D capital expenditures can capture the innovation efforts of public corporations and thus explain market rewards for R&D investments.

The evidence shows that:

- ♦ R&D expenditures are positively and significantly related to firm returns the first year following the investment. In other words, Low R&D expenditure companies have lower following returns, while higher R&D expenditure firms have higher following returns.
- ♦ When adding the R&D expenditure variable, the relationship between book-to-price ratio (BP) and stock returns becomes unclear. There is no consistent

evidence that higher BP stocks have higher returns. The relationship between firm size and stock returns is significantly negative even after controlling for R&D expenditures. However, such correlation between firm size and stock returns are disappearing in the upper quintile R&D expenditure firms (those with higher R&D investments).

- ♦ R&D expenditures can also explain stock returns two and three years after the investment.

These findings confirm that investors value firm's innovation through R&D expenditures, especially for firms with higher R&D expenditures.

## SAMPLE CHARACTERISTICS

### Sample selection

All the sample firms are selected from the COMPUSTAT US active set. In keeping with previous research, three criteria are used: 1) the sample does not include American Depository Receipts (ADRs), financial companies, or utility companies; 2) Firms are excluded in cases where the PERMNO number in the Center for Research in Stock Price (CRSP) database was unavailable; and 3), Firms are deleted in cases where R&D expenditure data are not available beginning in 1990. To maximize the sample size as well as increase the variability in the crucial R&D variable, the common requirement that the ratio of R&D to market value exceed 2% was ignored. These restrictions resulted in a final sample of 1038 firms, 10380 firm-year data from 1990 to1999.

### Data

Each firm's accounting data are from COMPUSTAT, and return data are drawn from the CRSP database. R&D expenses represent all costs related to the development of new products or services incurred during the year. This variable represents an internal allocation; therefore more than a few firms do not have this data reported. In order to compare the R&D expenses among firms, two variables were used for scaling: the ratio of R&D expenses to firm's market value at fiscal year end (RDM) and the ratio of R&D expenses to firm's total assets at fiscal year end (RDA). In fact, the results for the two variables are similar. Book-to-price ratio (defined as quarterly common equity as reported divided by the monthly close price multiplied by quarterly common shares outstanding) was used to measure book-to-market ratio. Market value was produced by multiplying the number of shares outstanding by share prices at the end of the firms' fiscal year. Three years of annual return data after R&D expenditure is used for analysis. In other words, data for the first year return represents the annual return subsequent to the formation of the portfolio at the end of the fiscal year (for example, three years return from 2000 to 2002 are examined for 1999 R&D expenditures ).

## Sample Characteristics

Table 1 shows mean descriptive data of fundamental variables from the sample for each year from 1990 to 1999. The means for RDM (R&D to market value) and RDA (R&D to total assets) are generally distributed evenly among the ten year period. In sum, R&D expenditure is about 8.9 percent of a given firm's market value and 19.5 % of its total assets. The average market value of sample firms is about 2.7 billion.

**Table 1: Descriptive characteristics of sample firms on each sample year**
Numbers in the table are the mean value of each fundamental variable

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 1990-99 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RDM | 0.135 | 0.101 | 0.096 | 0.082 | 0.084 | 0.071 | 0.065 | 0.073 | 0.103 | 0.083 | 0.089 |
| RDA | 0.187 | 0.170 | 0.202 | 0.187 | 0.213 | 0.208 | 0.189 | 0.218 | 0.217 | 0.154 | 0.195 |
| MV | 1195.2 | 1448.2 | 1467.4 | 1653.2 | 1732.5 | 2266.1 | 2773.6 | 3645.3 | 4580.5 | 5966.0 | 2717.5 |
| BP | 0.503 | 0.508 | 0.411 | 0.488 | 0.510 | 0.377 | 0.405 | 0.325 | 0.208 | 0.182 | 0.388 |
| RET1 | 0.779 | 0.233 | 0.233 | 0.048 | 0.562 | 0.185 | 0.215 | -0.034 | 0.535 | 0.008 | 0.277 |
| ATOE | 2.601 | -0.215 | 3.070 | 3.250 | 2.436 | 1.911 | 1.977 | 0.775 | 2.674 | 2.688 | 2.116 |
| CF | 2803.4 | 1804.3 | 2298.1 | 2482.0 | 2749.2 | 3705.5 | 3957.5 | 3855.9 | 842.4 | 3052.8 | 2755.8 |

Notes:
RDM is the ratio of R&D expenses to market values at the fiscal year end. RDA is the ratio of R&D expenses to total assets at the fiscal year end. RET1is stock returns for first subsequent year after the R&D expenditures. MV is the market value in millions of dollars calculated as the stock price times the shares outstanding at the fiscal year end. BP is the ratio of book to price, defined as the common equity divided by market value at the fiscal year end. ATOE is total assets divided by stockholders' equity, which represents the leverage level. CF is the cash flow divided by common shares outstanding.

It is interesting to examine firms' characteristics with respect to the level of R&D spending. Table 2 shows the mean fundamental values on 10 RDM categories (Firms are sorted by RDM first and then evenly divided to 10 groups). The lowest RDM is 0.004 while the highest RDM is 0.585. It is noted that the first year returns subsequent to R&D expenditures (RET1) also increase from 0.142 (lowest RDM decile) to 0.866 (highest RDM decile). The second and third subsequent annual market returns also have this trend. Firms' market value decreased from the lowest to highest decile. So the lower RDM might be caused by the high denominator- firm's market value. Thus, from this raw data, it cannot be concluded that that RDM has a strong positive relationship with RET1 since this relationship could be distorted by firm size.

| Table 2: Decile portfolio's fundamental values based on RDM ranking | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| All sample observations (firm-year) were ranked by RDM and placed into 10 groups. Numbers in the table are the mean fundamental values for each group. The total observations are 9872 after deleting some missing data. The sample period is from 1990 to 1999. | | | | | | | | |
| RDM | Fundamentals | | | | | | | |
| | RDM | RET1 | RET2 | RET3 | MV | BP | CF | ATOE |
| 1 (Low) | 0.004 | 0.142 | 0.202 | 0.141 | 6393.17 | -0.195 | 3.000 | 2.754 |
| 2 | 0.012 | 0.145 | 0.106 | 0.098 | 4783.317 | 0.360 | 1.502 | 1.298 |
| 3 | 0.019 | 0.183 | 0.139 | 0.184 | 4138.641 | 0.344 | 1.540 | 2.068 |
| 4 | 0.027 | 0.214 | 0.207 | 0.180 | 3284.656 | 0.423 | 1.189 | 3.353 |
| 5 | 0.038 | 0.230 | 0.197 | 0.196 | 2669.491 | 0.435 | 1.167 | 1.317 |
| 6 | 0.054 | 0.266 | 0.253 | 0.275 | 1623.035 | 0.452 | 0.265 | 3.841 |
| 7 | 0.076 | 0.292 | 0.260 | 0.272 | 1089.988 | 0.567 | 0.477 | 0.353 |
| 8 | 0.115 | 0.300 | 0.334 | 0.323 | 981.962 | 0.634 | -0.068 | 2.333 |
| 9 | 0.201 | 0.503 | 0.334 | 0.325 | 831.182 | 0.683 | 0.048 | 2.420 |
| 10 (High) | 0.585 | 0.866 | 0.530 | 0.309 | 85.200 | -0.044 | -1.094 | 2.001 |

Notes:

RDM is the ratio of R&D expenses to market value at the fiscal year end. RET1, RET2, and RET3 are stock returns for first, second, and third year after the R&D expenditures, respectively. MV is the market value calculated as the stock price times the shares outstanding at the fiscal year end. BP is the ratio of book to price defined as the common equity divided by market value at the fiscal year end. ATOE is total assets divided by stockholders' equity, which represent the leverage level. CF is total cash flow divided by common shares outstanding.

In order to filter the effects of firm size and book to price ratio, it is necessary to sort firms both on RDM and size or RDM and book to price ratio, which is shown in Table 3. Panel A shows that the one year return decreases with firm's market value when controlling for the RDM. However, if the data are examined in rows, the one year returns increase from 0.319 to 0.942 for the lowest market value firms. Preliminary results confirm that one year returns increase as RDM increases when the market value is controlled for. Panel B represents one year returns for all sample firms sorted by RDM and book to price ratio. When controlling for the RDM effects, returns do not appear to have a systematic increase associated with the Book to Price ratio. In the low RDM quintile, the return for lowest BP is 0.163, while for the highest BP it is 0.162. However, when the Book to price ratio is controlled for, returns appear to increase systematically with an increase of RDM. For example, for the lowest book to price group, the return increases from 0.163 to 0.580. In conclusion, Table 3 shows that the highest RDM quintile has larger returns than the lowest RDM quintile when market value and book to price ratio are controlled for.

**Table 3: One year return sorted by RDM, MV, and BP for all sample firms**

**Panel A: Mean of RET1 for all sample firms sorted on RDM**
(the ratio of R&D capital to market value) and MV (market value)

| | | (Low) | | RDM | | (High) |
|---|---|---|---|---|---|---|
| MV | | 1 | 2 | 3 | 4 | 5 |
| (Low) | 1 | 0.319 | 0.335 | 0.426 | 0.449 | 0.942 |
| | 2 | 0.117 | 0.120 | 0.240 | 0.368 | 0.666 |
| | 3 | 0.062 | 0.157 | 0.137 | 0.236 | 0.601 |
| | 4 | 0.103 | 0.176 | 0.223 | 0.258 | 0.544 |
| (High) | 5 | 0.156 | 0.216 | 0.239 | 0.205 | 0.509 |

**Panel B: Mean one-year-ahead returns of all sample firms sorted on RDM**
(the ratio of R&D capital to market value) and BP (ratio of book to price)

| | | Low | | RDM | | High |
|---|---|---|---|---|---|---|
| BP | | 1 | 2 | 3 | 4 | 5 |
| Low | 1 | 0.163 | 0.212 | 0.199 | 0.294 | 0.580 |
| | 2 | 0.114 | 0.242 | 0.227 | 0.240 | 0.606 |
| | 3 | 0.119 | 0.183 | 0.276 | 0.314 | 0.630 |
| | 4 | 0.162 | 0.167 | 0.273 | 0.368 | 0.691 |
| High | 5 | 0.162 | 0.190 | 0.262 | 0.260 | 0.563 |

Notes:
- RET1is stock returns for first subsequent year after the R&D expenditures.
- MV is the market value in millions of dollars calculated as the stock price times the shares Outstanding at the fiscal year end.
- BP is the ratio of book to price, defined as the common equity divided by market value at the fiscal year end.

Since the sample is large (1038 firms over 10 years) and some firms have very low R&D expenses (such as 0 expenses), it is necessary to check the R&D effects on large RDM (or RDA) firms to avoid the effects of outlier disorder. Large R&D expense firms are defined as the firms in the upper quintile when sorted by RDM or RDA. Table 4 represents one year returns for upper quintile RDM firms when sorted by RDM and market value or RDM and book to price ratio. Panel A of Table 4 shows that returns do not exhibit a discernable relationship with market value unlike that shown in Table 3 panel A. However, examination of the rows reveals that returns have a clear and systematic increasing trend associated with an increase of RDM. The results in panel B table 4 provide similar results as seen in panel B table 3.

| Table 4: One year returns sorted by RDM, MV, and BP for upper quintile RDM firms | | | | | | |
|---|---|---|---|---|---|---|
| **Panel A: Mean of RET1for upper quintile RDM firms, sorted on RDM and MV** | | | | | | |
| | | Low | | RDM | | High |
| MV | | 1 | 2 | 3 | 4 | 5 |
| Low | 1 | 0.819 | 0.736 | 0.818 | 0.591 | 1.145 |
| | 2 | 0.492 | 0.401 | 0.551 | 0.414 | 1.357 |
| | 3 | 0.664 | 0.356 | 0.558 | 0.337 | 0.989 |
| | 4 | 0.240 | 0.339 | 0.824 | 0.630 | 0.917 |
| High | 5 | 0.350 | 0.405 | 0.469 | 0.765 | 0.986 |
| **Panel B: Mean of RET1for upper quintile RDM firms, sorted on RDM and BP** | | | | | | |
| | | Low | | RDM | | High |
| BP | | 1 | 2 | 3 | 4 | 5 |
| Low | 1 | 0.592 | 0.750 | 0.517 | 0.331 | 0.869 |
| | 2 | 0.389 | 0.223 | 0.943 | 0.742 | 0.774 |
| | 3 | 0.299 | 0.417 | 0.524 | 0.537 | 1.703 |
| | 4 | 0.500 | 0.486 | 0.822 | 0.618 | 0.840 |
| High | 5 | 0.676 | 0.281 | 0.301 | 0.420 | 0.916 |

Notes:
- RDM is the ratio of R&D expenses to market values at the fiscal year end.
- RET1is stock returns for first subsequent year after the R&D expenditures.
- MV is the market value in millions of dollars calculated as the stock price times the shares outstanding at the fiscal year end.
- BP is the ratio of book to price, defined as the common equity divided by market value at the fiscal year end

The main descriptive results from Table 2, Table 3, and Table 4 give a clear indication of a relationship between one year returns and RDM even after controlling for market value or book to price ratio. This relation is robust for the whole sample firms and for larger R&D expenditure firms.

## REGRESSION ANALYSIS

Further insight into the relationship between RDM (or RDA) and stock returns can be obtained through OLS regression analysis. In our study, regression models are designed with RDM or RDA as additional independent variables in addition to other factor variables like market return, book to market ratio, and firm size. Future first, second, and third year buy and hold returns are dependent variables. Regressions are run cross sectionally and cross serially. These models can be generally expressed as:

$$RET_{i,\,t+j} = c_{0,j} + c_{1,j}\,MR_{t+j} + c_{2,j}\,Log(BP)_{it} + c_{3,j}Log\,(MV)_{it} + c_{4,j}\,Log\,(RDM\ or\ RDA)_{it} + c_{5,j}\,Log\,(ADA)_{it} + e_{it}\ \ (j=1, 2, 3)$$

- $RET_{i,\,t+j}$ (j=1,2,3) is firm's the first, second, and third subsequent annual return after fiscal year t.
- $MR_{t+j}$ is the first, second, and third subsequent market annual returns after fiscal year t. These market return data are from the CRSP database.
- $BP_{it}$ is the ratio of book to price defined as common equity divided by market value at the end of fiscal year t for firm I.
- $RDM_{it}$ (or $RDA_{it}$ ) is the ratio of R&D expenses to market value (or total assets) at the end of fiscal year t for firm I.
- $MV_{it}$ is the market value in millions (dollars) calculated as the stock price multiplied by outstanding shares at the end of fiscal year t for firm I.
- $ADA_{it}$ is the ratio of advertising expenses to total assets at fiscal year end t for firm i.

The ratio of advertising expenses to total assets was included as an independent variable in the regressions. This is to examine the possibility that advertising expenditures exhibit similar effects on stock returns as R&D expenditures. This was done because both R&D and Advertising expenditures are viewed as an investment that should impact future returns.

Table 5 shows the results for three regressions. Regression 1 is a simple multiple regression with book-to-price ratio, market value, and market return as independent variables. As expected, market value has a large negative and significant coefficient, which is consistent with previous studies (e.g. Fama & French 1992). The effects of book-to-price ratio are unclear, as significance depends upon the presence of other independent variables. RDA (the ratio of R&D to total asset) is highly significant, with a coefficient of 0.080 and t-value 8.74. After adding RDA in the basic regression, the adjusted $R^2$ increases from 0.048 to 0.055. The variable RDM (the ratio of R&D expenses to market value) has the similar effect as RDA (to save spaces, results are not reported). Advertisement to total assets was universally insignificant in these regressions.

Table 6 represents the results of two regressions for upper quintile RDM firms. Table 4 provided evidence that RDM has a positive and significant effect on subsequent returns for upper quintile RDM firms. These regression results provide clear support for preliminary indications gathered from the descriptive statistics shown in Tables 1 through 4. The coefficient of RDM is 0.396, which is much larger than the coefficient for the aggregate sample. For upper quintile firms, market value loses its explanatory power for returns as evidenced by a lack of significance (t- value = –1.58). Thus, from Tables 5 and Table 6, it can be concluded that R&D investments have significant and positive effects on future (one year) returns.

**Table 5: Regression results on one year stock returns for all sample firms**

| Regressions | Intercept | MR | Log(BP) | Log(MV) | Log (RDA) | Log (ADA) | *Adj* $R^2$ |
|---|---|---|---|---|---|---|---|
| 1 | 0.094 | 0.855 | 0.002 | -0.030 | | | 0.048 |
| | (2.84) | (18.82) | (0.16) | (-6.35) | | | |
| 2 | 0.311 | 0.839 | 0.048 | -0.016 | 0.080 | | 0.055 |
| | (7.52) | (18.50) | (3.62) | (-3.23) | (8.74) | | |
| 3 | 0.393 | 0.697 | 0.026 | -0.020 | 0.075 | 0.015 | 0.055 |
| | (4.12) | (9.56) | (1.13) | (-2.46) | (4.56) | (1.037) | |

Notes:

The t-values are in the parenthesis.

Regressions:

$RET_{i,\,t+1} = c_0 + c_1MR_{t+1} + c_2\,Log(BP)_{it} + c_3Log\,(MV)_{it} + c_4Log\,(RDA)_{it} + c_5Log\,(ADA)_{it}$

The regressions are run on cross section and cross sample period.

- $RET_{i,\,t+1}$ is firm's first subsequent annual return after fiscal year t.
- $MR_{t+1}$ is market annual returns at year t+1. It is from CRSP database.
- $BP_{it}$ is the ratio of price to book defined as the common equity divided by market value at the fiscal year end.
- $RDA_{it}$ is the ratio of R&D expenses to total assets at fiscal year end.
- $MV_{it}$ is the market value in millions of dollars calculated as the stock price times the shares outstanding at the fiscal year end.
- $ADA_{it}$ is the ratio of advertisement expenses to total assets at fiscal year end.

**Table 6: Regression results on one-year-ahead stock returns for upper quintile RDM Firms**

| Regressions | Intercept | MR | Log(BP) | Log(MV) | Log(RDM) | *Adj* $R^2$ |
|---|---|---|---|---|---|---|
| 1 | 0.259 | 1.222 | -0.100 | -0.067 | | 0.028 |
| | (1.73) | (5.48) | (-1.66) | (-2.59) | | |
| 2 | 0.709 | 1.218 | -0.136 | -0.042 | 0.396 | 0.038 |
| | (3.69) | (5.49) | (-2.24) | (-1.58) | (3.71) | |

Notes:

The t-values are in the parenthesis.

Regressions:

- $RET_{i,\,t+1} = c_0 + c_1MR_{t+1} + c_2Log(BP)_{it} + c_3Log\,(MV)_{it} + c_4Log\,(RDM)_{it}$
- The regressions are run on cross section and cross sample period for upper quartile RDM firms.
- $RET_{i,\,t+1}$ is firm's first subsequent annual return after fiscal year t.
- $MR_{t+1}$ is market annual returns from CRSP database.
- $BP_{it}$ is the ratio of price to book defined as the common equity divided by market value at the fiscal year end.
- $RDM_{it}$ is the ratio of R&D expenses to firm's market value at the fiscal year end.
- $MV_{it}$ is the market value in millions of dollars calculated as the stock price times the shares outstanding at the fiscal year end.

Table 7 represents the results of regressions with the second and the third year returns as dependent variables. These results reveal that both RDA and book-to-price ratio are significant with respect to second and the third year returns. Interestingly, market value loses its explanatory power for third year returns.

**Table 7: Regression results on two year and three year stock returns for all sample firms**

| Dependent variables | Intercept | MR | Log(BP) | Log(MV) | Log(RDA) | *Adj* $R^2$ |
|---|---|---|---|---|---|---|
| RET2 | 0.737 | -0.420 | 0.081 | -0.016 | 0.061 | 0.020 |
| | (18.43) | (-9.62) | (6.31) | (-3.40) | (7.02) | |
| RET3 | 0.342 | 0.206 | 0.039 | -0.004 | 0.050 | 0.007 |
| | (7.38) | (3.80) | (2.75) | (-0.81) | (5.15) | |

Notes:

The t-values are in the parenthesis.

Regressions:

- $RET_{i,t+j} = c_{0,j} + c_{1,j} MR_{t+j} + c_{2,j} Log(BP)_{it} + c_{3,j} Log(MV)_{it} + c_{4,j} Log(RDA)_{it}$ (j=2, 3)
- The regressions are run on cross section and cross sample period for upper quartile RDM firms.
- RET2 and RET3 are firm's second and third subsequent annual return after fiscal year t.
- $MR_{t+j}$ is market annual returns from CRSP database.
- $BP_{it}$ is the ratio of price to book defined as the common equity divided by market value at fiscal year end.
- $RDA_{it}$ is the ratio of R&D expenses to firm's total assets at fiscal year end.
- $MV_{it}$ is the market value in millions of dollars calculated as the stock price times the shares outstanding at fiscal year end.

## CONCLUSIONS

The results support the proposition that R&D investments can reflect investors' expectation of firms' future abnormal profits. This study examines the effects of RDA and RDM on subsequent annual stock returns. The major findings are: R&D investments measured as a ratio of R&D to a firm's market value or total assets are significantly associated with firm's subsequent returns when other fundamental variables are controlled for. Such effects are larger for upper quintile R&D investment firms than for total sample firms. For larger R&D investment firms, the market value variable becomes insignificant in its ability to explain firms' subsequent returns. R&D investments affect firm returns up to three years past the investment period. All together, these results provide evidence of R&D effects on stock returns. Questions for future research may include whether R&D expenditures are associated with risk premium or market mispricing behavior. In addition, it would be interesting to understand with greater clarity why it is that higher R&D investments are followed by higher subsequent returns.

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# A LONGITUDINAL PERSPECTIVE OF NONARTICULATION IN THE STATEMENT OF CASH FLOWS

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## ABSTRACT

*Previous studies have documented numerous occasions of nonarticulation in the statement of cash flows. Nonarticulation occurs when annual changes in the current accounts presented in the balance sheet differ from corresponding changes reported in the statement of cash flow. This paper contributes to our understanding of this issue by studying nonarticulation from 1987 through 2006. We update Bahnson et al. (1996) and further parse their sample, finding that the nonarticulation as reported by them continues. The number of companies that completely articulate has declined over the past 20 years. However, the number of companies with extraordinarily large nonarticulation has also declined. Furthermore, we find that nonarticulation has increased at a faster rate in inventory and receivables than other areas. Articulation of depreciation, however, has increased during the sample period. These results are relevant to the discussion of transparency in financial statements and the running debate on the preference of the direct or indirect method for presenting the statement of cash flows.*

## INTRODUCTION

".. We all knew that transparency is important for the operation of financial markets, but to this time few thought that it could be worth 5 per cent of the U.S. GDP and possibly more. Now that we know this, financial market regulators will have to keep it into account for the future" (Pagano, 2008). One of the major reasons for the crisis in the financial markets has been the difficulty in valuing the assets (such as mortgage backed securities and collateralized debt obligations) on the books of banks due to the complexity of the securities and opacity in pricing practices.

Problems from opacity are not limited to derivative securities. A review of the popular press indicates that accounting scandals of the Enron era have increased regulating bodies' focus on accurate, informative financial statements. Recent emphasis on proforma results and other GAAP derived performance measures also increases the necessity for transparent and accurate GAAP information.

In accounting, articulation has been defined as the manner in which one statement (the statement of cash flow) is mathematically linked to another (the balance sheet). Nonarticulation occurs when annual changes in the current accounts presented in the balance sheet differ from corresponding changes reported in the statement of cash flow (SCF). (Technically nonarticulation also includes non-operating changes in the current accounts and operating changes in the non-current accounts. But for ease of comparison, we adopt the definition and estimation of nonarticulation used in previous studies). Could nonarticulation be a possible means of obscuring information content in the cash flow statement?

While previous nonarticulation studies have documented its existence, our study provides an understanding of how this phenomenon has changed over time. Articulation has declined during the past 20 years, but the percentage of firms with very large amounts of nonarticulation has also decreased substantially. We add to the body of knowledge by documenting the variation in nonarticulation across accounts types. Receivables and inventory show the largest decline in articulation while articulation of depreciation has actually increased. For pedagogy, our findings can provide better understanding of nonarticulation in the SCF, leading to a deeper discussion of the issue of the direct method versus the indirect method.

## REVIEW OF RELEVANT LITERATURE

One of the first papers to identify the possibility of nonarticulation among the published financial statements is Bahnson et al. (1996). The study examines 9,757 financial statements from 1987 to 1990 and investigates the ability to replicate published net operating cash flow using the information from the balance sheet and income statement. The authors estimate net operating cash flow by starting from the reported income and eliminating all non-cash items. They compare this computed amount with the reported cash flow. Any difference between these two amounts provides a measure of degree of nonarticulation in the financial statements.

Wilkins and Loudder (2000) identify companies for which the 1998 financial statements articulate. Further, the authors examine nonarticulation at the sub-item level and discuss the implications for educators. Kinnunen and Koskela (1999) document the existence of nonarticulation among financial statements of Finnish companies, suggesting that the existence of nonarticulation is not limited to US companies. Miller (2002) finds significant nonarticulation in Hong Kong companies also.

The discussion on nonarticulation is also related to the debate on the merits of the direct method versus the indirect method of presenting the statement of cash flows. White et al. (2002) decompose Pfizer's 1999 financial statement and, using footnote disclosures, derive a direct method SCF. They further explain that the indirect method SCF does not articulate, nor should it do so. They note that reconciling items can include mergers/acquisitions, divestitures and foreign currency translation adjustments.

Proponents of the usefulness of the indirect method cite its income statement base, simplicity of creation, and the GAAP requirement for the direct method to be reconciled to the indirect method, but not vice versa (Golub and Huffman, 1984). On the other side of the debate, numerous papers support normative arguments that the direct method is superior to the indirect method. In this context, because of limitations in data collection to empirically test the superiority of one method over the other, perhaps identifying reasons for nonarticulation could mitigate the criticisms associated with nonarticulation.

From an empirical standpoint, many accounting studies have documented that cash flow disclosure is useful. (See Neil, Schaefer, Bahnson, and Bradbury, 1991). Brahmasrene, Strupeck, and Whitten (2004) found in a survey that 82% of CEOs, CFOs, and managers preferred the indirect method compared to 70.3% of investors and analysts.

The vast majority of companies in the U.S. prepare the statement of cash flows using the indirect method. Of the 600 companies surveyed in *Accounting Trends & Techniques 2007*, only 6 used the direct method (AICPA, 2008). Hence, empirical literature on method choice is scant, making it difficult to draw appropriate comparison samples Studies of other nations, for example New Zealand, Australia, Sweden, and South Africa, are similarly constrained because only the direct method is allowed. The existing empirical literature does document three items: (1) that cash flows do have information content (Livnat and Zarowin, 1990) and predictive ability (Krishnan and Largay III, 2000); (2) that changes in accruals also have information content, perhaps more information content than cash flows, at least in certain situations (Joseph and Lipka, 2005) and; (3) that the statement of cash flows is not exactly articulated (Drtina and Largay III, 1985; Bahnson et al. 1996; and Kinnunen and Koskela, 1999; and Miller, 2002).

Adding to (3) above, we document the changing nature of the nonarticulation across time. The objectives of this study are the following: (1) to update Bahnson et al. (1996), identifying changes in the magnitude and continued existence of nonarticulation, (2) to follow the general pattern of nonarticulation over time, and (3) to identify changes in nonarticulation by account type.

## DATA

The data for our study are taken from Compustat Annual Industrial, Research and Full coverage files for the years 1987–2006. The primary sample consists of non-financial companies for which financial statement data is available. For ease of comparison, our variables are computed consistent with Bahnson et al. (1996) and Wilkins and Loudder (2000).

Variables of interest are defined as follows:

ROCF - Reported operating cash flow is Compustat variable OANCF.
IOCF - Independently calculated operating cash flow is estimated using the following equation:

$$\begin{aligned} IOCF = {} & IBC + DPC + XIDOC + TXDC + ESUBC + SPPIV + FOPO - ACT(t) \\ & + ACT(t-1) + CHE(t) - CHE(t-1) + LCT(t) - LCT(t-1) - DLC(t) \\ & + DLC(t-1) \qquad (1) \end{aligned}$$

where:

| | | |
|---|---|---|
| IOCF | = | Independently calculated Operating Cash Flow |
| IBC | = | Income before extraordinary items. Discontinued items,and cumulative effects of changes in accounting principles |
| DPC | = | Depreciation, Depletion and discontinued items |
| XIDOC | = | Extraordinary items and discontinued items |
| TXDC | = | Deferred income tax expense |
| ESUBC | = | Equity earnings from unconsolidated subsidiaries |
| SPPIV | = | Gains and losses from the sale of property, plant and equipment and investments. |
| FOPO | = | Funds from operations (other) |
| ACT | = | Total current assets |
| CHE | = | Cash and cash equivalents |
| LCT | = | Total current liabilities |
| DLC | = | Total debt in current liabilities, including both current notes payables and the current maturities of long-term debt. |

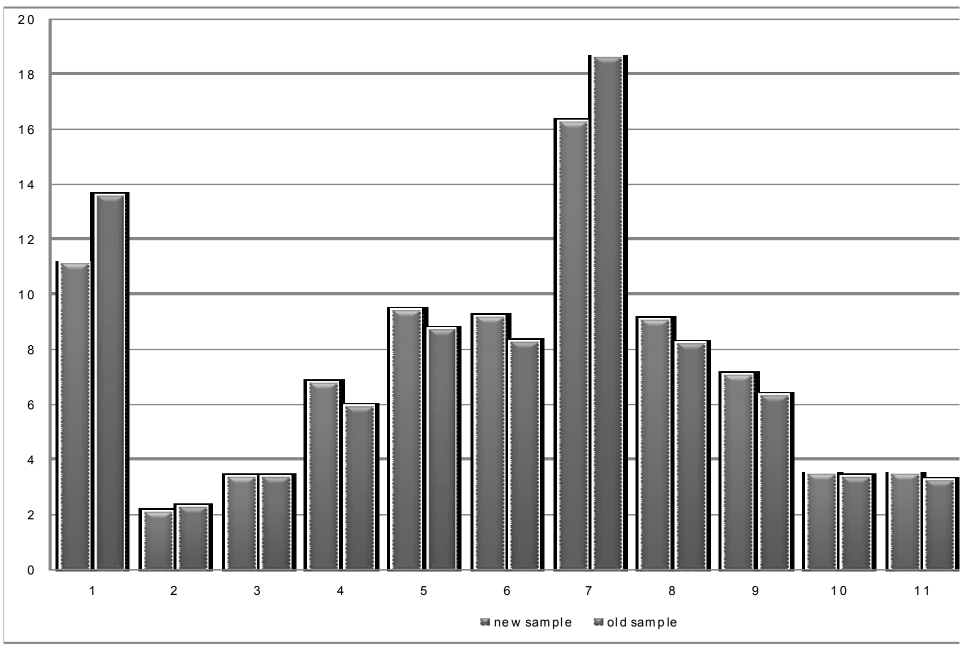
REP-CALC is ROCF less IOCF, scaled by ROCF. A positive number indicates that reported cash flow is larger than independently computed cash flow.

## ANALYSIS OF RESULTS

Using the sample and the methodology described, we estimate the difference between reported operating cash flows on the statement of cash flows (ROCF) and calculated operating cash flows from changes in current balance sheet accounts (IOCF). We scale the difference by the reported operating cash flow in order to obtain a percentage measure of differences (REP-CALC). A positive difference indicates that the reported cash flow is larger than the independently calculated amount. In exhibit 1, these values are classified into the 13 groups used by Bahnson et al. (1996). Positive differences of greater than 1, .75 to 1, .5 to .75, .25 to .5, .10 to .25, and .03 to .10 are represented by groups 1 thru 6, respectively. Group 7 surrounds a difference of zero (.03 to -.03), and groups 8-13 represent negative differences mirroring the positive differences in groups 1 to 6.

Exhibit 1 replicates and extends Bahnson et al. (1996). It shows the distribution of differences between reported and calculated operating cash flows for the Bahnson et al. (1996) sample of the years 1987-1990 (old sample), and the entire sample of years 1987-2006 (new sample). Visually, there is little overall difference between these distributions. This suggests that the phenomenon of non-articulation is not limited to the period just after the requirement for the SFAS 95 statement of cash flows.

**Exhibit 1: Replication sample vs. expanded sample**




We also observe that in exhibit 1, 17% of the observations have immaterial differences, defined as differences between reported and calculated operating cash flows between +3% to -3%. Further, about 11% of the observations have differences greater than a 100% on both the positive and the negative side. In other words, about 22% of the observations were off by more 100% of the reported operating cash flow amount. Visually, the differences on the positive side and negative sides are symmetrically distributed.

Next, we study articulation over time. Building on Bahnson et al. (1996), Wilkins and Loudder (2000) identify 74 major public companies with articulating financial statements. We compute articulation for the 74 articulating firms identified by Wilkins and Loudder (2000) for subsequent years. Exhibit 2 presents the results. The number of these firms articulating in subsequent years drops markedly, from 74 in the initial sample to 50, 37, 31, and 12 in years t+1, t+2, t+3, and t+4 respectively. Untabled OLS regression estimates a decline of 4.79 companies per year. The regression line appears superimposed on exhibit 1. This computation lends no support to any assertion of persistence in the sample.

Exhibit 1 suggests that there has been little change in the shape of the distribution of nonarticulation, yet exhibit 2 shows a significant decline in articulation among firms that did articulate at one point in time. This could be the result of at least two phenomena. First, nonarticulating firms may become articulators at a similar rate to firms becoming nonarticulators. Second, since both samples in exhibit 1 span a number of years, an averaging phenomenon may be taking place in both samples, masking a similar decline in articulation in each.

**Exhibit 2: Decline of articulating firms over time - Wilkins and Loudder (2000) sample**

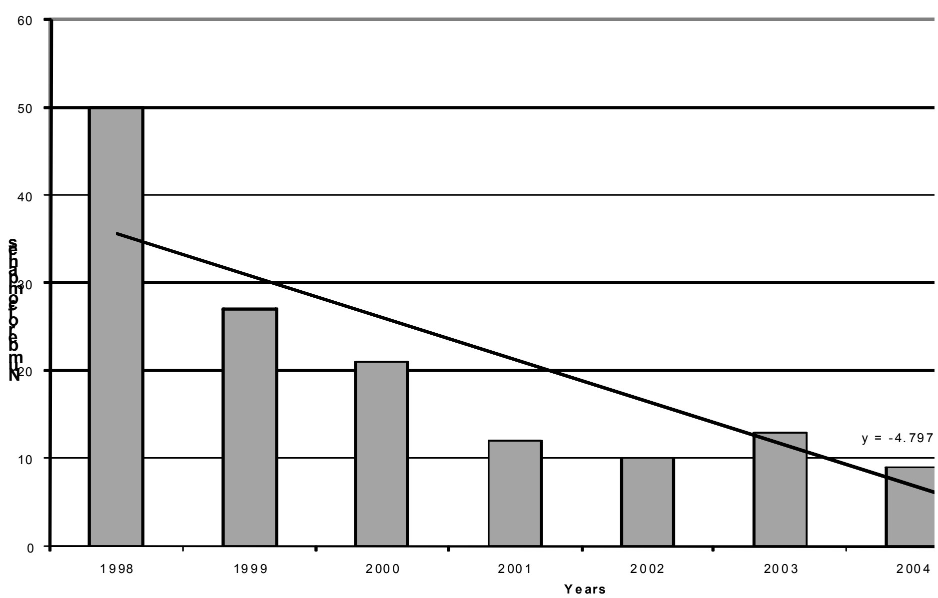



Exhibit 3 compares articulation in 1988 with 2006. Computations in exhibit 3 are analogous to those in exhibit 1. However, exhibit 3 removes the effect of averaging by comparing articulation in 1988 to articulation in 2006. The data exhibit a decline in group 7 articulation (the group surrounding complete articulation). It is also apparent that in 2006 there are fewer data points in groups 1 and 13 than in 1988. "Complete" articulation has declined over the time period, but so has nonarticulation over 100 percent. The 9 percent decline in the nonarticulation of groups 1 and 13 is greater than the 3 percent decline in articulation for the center group 7.

Taken together, the data in exhibits 1-3 show a change in articulation since 1987. Firms that articulated tended to decline in articulation. Group 7 (complete) articulation has declined, but more firms are closer to articulation in 2006 than in 1988. Exhibit 4 tracks changes in the three articulation levels developed by Wilkins and Louder (2000). These articulation levels are progressive; level 2 articulators also articulate at level 1, level 3 articulators articulate at levels 1 and 2.

**Exhibit 3: Articulation over time – Comparison of the beginning and end years**

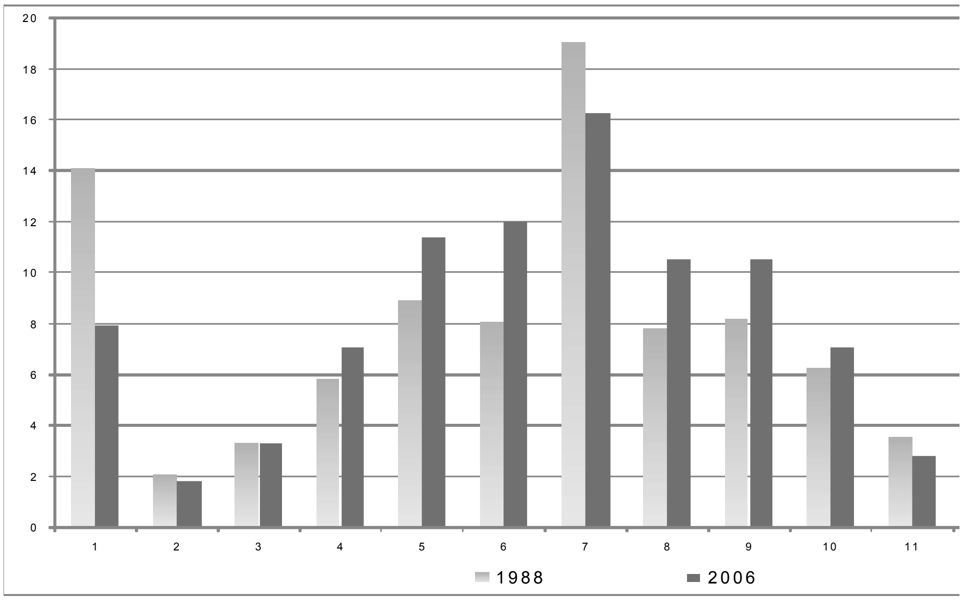
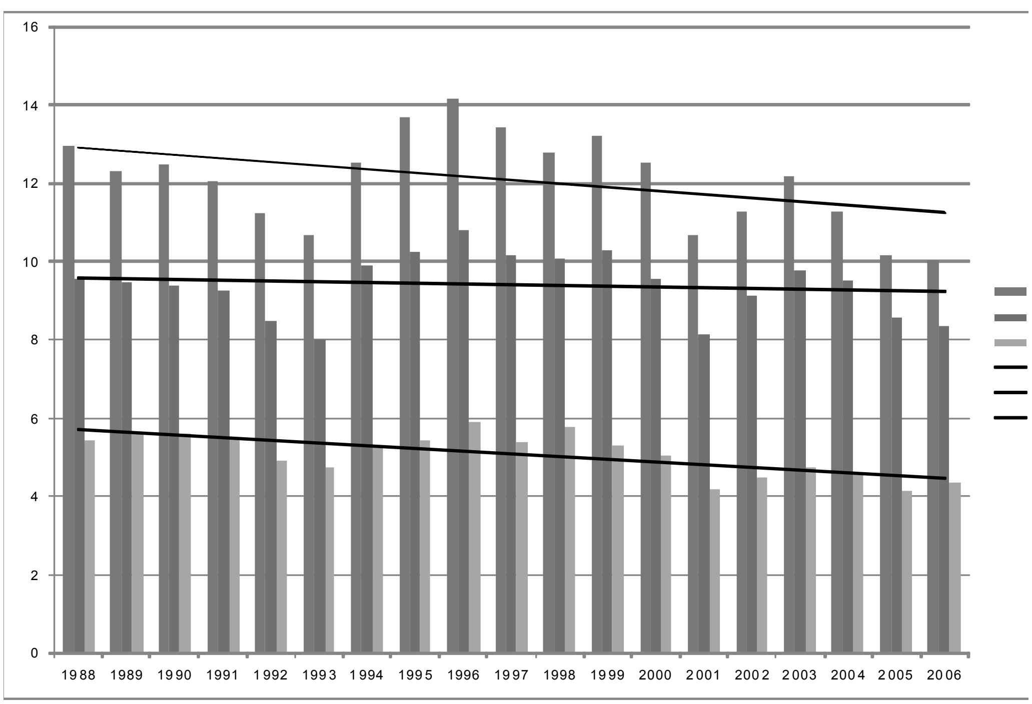



**Exhibit 4: Articulation over time – Differences across levels of articulation**

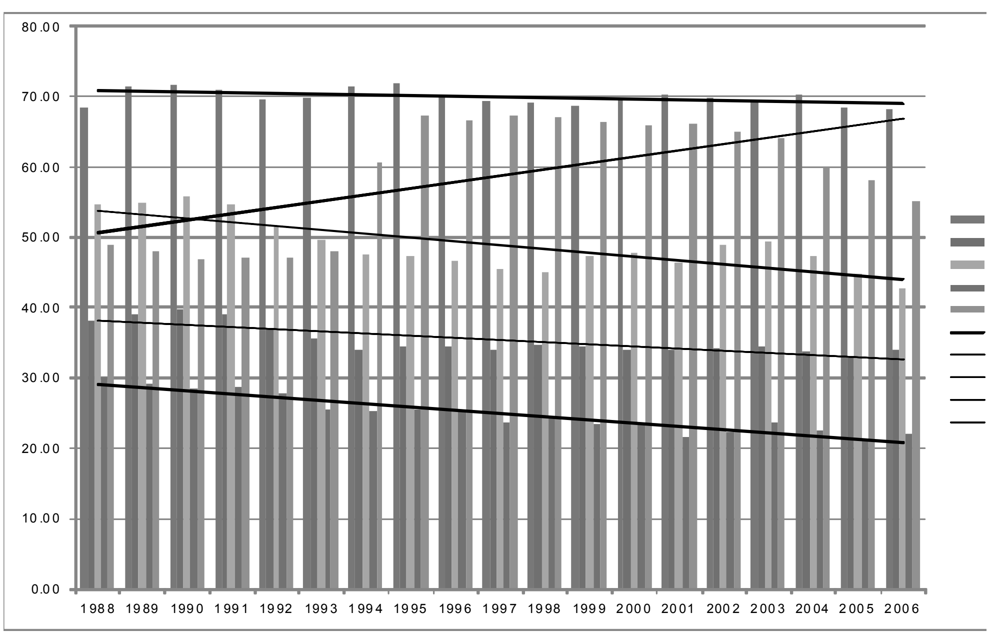


Articulation is defined as a change in balance sheet items being within $1,000 of the amount reported on the statement of cash flows. Level 1 articulation is defined as firms articulating with respect to receivables, inventory, and depreciation. Level 2 articulation is defined as firms articulating with respect to receivables, inventory, depreciation, and deferred taxes. Level 3 articulation is defined as firms articulating with respect to receivables, inventory, depreciation, deferred taxes, and payables. Level 3 articulation is a subset of level 2 articulation, which is a subset of level 1 articulation.

Levels 1-3 articulation change at different rates over time. Regressions estimating the slope of the change appear in table 1. The regression lines themselves are superimposed on exhibit 4. Level 1 articulation has a slope of -.09, a little less than 10 percent per year. Level 2 articulation does not significantly change over the period of 1988 through 2006. Level 3 articulation declines -.07 percent per year. The decline in articulation associated with the asset accounts, level 1 articulation, is larger than that associated with asset and liability accounts combined.

Exhibit 5 breaks down articulation further into individual balance sheet accounts. Regression lines described in table 1 are superimposed on exhibit 5. The annual decline in the articulation of inventory and receivable assets is -.53 and -.46 percent, respectively. Payables and deferred taxes decline less than inventory and receivables; -.31 and -.10 percent, respectively. Notably, depreciation actually increases articulation .89 percent per year.

**Exhibit 5: Articulation over time - Differences across balance sheet accounts**



| Table 1: Regressions over time | | | |
|---|---|---|---|
| Type of Articulation | Intercept (p-value) | Slope (p-value) | Adjusted R-Square |
| Level 1 articulation | 13.03 (0.0001) | -0.09(0.0594) | 0.15 |
| Level 2 articulation | 9.61 (0.0001) | -0.02 (0.5470) | -0.03 |
| Level 3 articulation | 5.77 (0.0001) | -0.07 (0.0007) | 0.47 |
| Receivable articulation | 29.53 (0.0001) | -0.46 (0.0001) | 0.88 |
| Inventory articulation | 54.24 (0.0001) | -0.53 (0.0001) | 0.60 |
| Depreciation articulation | 49.86 (0.0001) | 0.89 (0.0069) | 0.32 |
| Payables articulation | 38.53 (0.0001) | -0.31 (0.0001) | 0.67 |
| Deferred Taxes articulation | 70.93 (0.0001) | -0.10 (0.0359) | 0.19 |

## CONCLUSIONS AND IMPLICATIONS OF THE RESEARCH

This paper contributes to our understanding of nonarticulation in the statement of cash flows by studying nonarticulation over time. We find the following: (1) The occurrence of nonarticulation documented in Bahnson et al. (1996) continues, but the percentage of firms with very large amounts of nonarticulation has decreased substantially. This supports the notion that there is some improvement in transparency related to articulation. (2) Articulation does not persist for Wilkins and Loudder's (2000) list of articulating companies. Thus companies articulating in one year may or may not articulate in subsequent years. This is limited evidence suggesting that at least some nonarticulation is beyond the firms' control. (3) The rate of change in articulation varies by account. Receivables and inventory show the largest decline in articulation while articulation of depreciation has actually increased. As with (2) above, this finding suggests that the nature of business operations may be changing, with more consistency in physical plant operations, but more variability in financial and sales operations.

While documenting the changes in articulation over time, our findings also contribute to the discussion on the choice of direct or indirect method to report the statement of cash flows. Due to limitations in data collection to empirically test the superiority of one method over the other, we suggest that if the reasons for, or the sources of nonarticulation can be identified an analyst might mitigate the negative implications of nonarticulation. However, after numerous untabled attempts, the low explanatory power of our models explaining nonarticulation indicates that further research needs to done on the identification of additional important factors or functional forms modeling nonarticulation. Such a project is beyond the scope of this research.

Our findings have pedagogical relevance, as well, by tracking changes in articulation of various accounts. Articulation, although not commonly referred to in practice, has always been presumed in the classroom creation of the third financial statement whether it was the statement of changes in financial position or the statement of cash flows. This presumption simplifies the teaching process of the statement and enables students to grasp the concept of the relationship among the three traditional statements. Nonarticulation has always existed in published financial statements going back to the statement of changes in financial position whether prepared on a working capital or cash basis. Sources of nonarticulation in the statement are identified as a normal part of the audit process, and are not presumed to be the result of management manipulations.

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# SHORT TERM MARKET REACTION TO EARNINGS RESTATEMENTS: VALUE STOCKS VIS-À-VIS GLAMOUR STOCKS

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## INTRODUCTION

It has long been reported that value (or contrarian) strategies outperform the market since Graham and Dodd (1934), which is counter evidence to the efficient market hypothesis. This strategy calls for buying value stocks and selling glamour stocks. The value stocks are under-priced stocks relative to their intrinsic value indicators such as book value, earnings, cash flows, growth rate, while glamour stocks are over-price stocks relative to their intrinsic value indicators (E.g., Lakonishok et al., 1994).

Various hypotheses have been proposed to explain why the return differential between value stocks and glamour stocks persists so long. For examples, Fama and French (1992, 1993, 1995, 1996) argue that value stocks are judged by the market to have poor earnings prospect and higher risks and, thus, are selling at lower prices relative to their book value (i.e., high BM ratio), while the opposite applies to glamour stocks. In one word, value stocks have higher expected returns because they are riskier than glamour stocks. But they fail to provide sufficient explanations for the return differential.

Lakonishok et al. (1994) argue that the return differential is caused by investors' naïve extrapolation of the past sales or earnings growth of a firm into the future: some investors tend to get overly excited about stocks doing very well in the past, usually glamour stocks, and buy them up, while they oversell stocks doing very bad in the past, usually value stocks. Consequently, glamour stocks are overpriced while value stocks are under priced. Thus, when stock prices finally return to the fundamentals in the long horizon, glamour stocks will have lower return than the value stocks. They also argue that the return differential between glamour stocks and value stocks may be due to the career concerns of portfolio managers: i.e., glamour stocks have lower career risk to portfolio managers than value stocks do. Since glamour stocks appear to be prudent investments and hence easy to justify to sponsors, many portfolio managers tilt toward glamour stocks. Conversely, most value stocks have warts and, if they blow up, the portfolio managers will look foolish since they should have known that the value stocks had problems. Thus, portfolio managers stay away from value stocks. (See Haugen (1999)) To test this naive extrapolation hypothesis, Lakonishok et al. (1997) form portfolios of glamour stocks and value stocks each year during 1971 through 1993 and examine the portfolio returns around the earnings announcement days in the post-formation period. They find that the return differentials around the earnings announcement account for approximately 25 to 30 percent of the annual return differentials between value stocks and glamour stocks in the first two to three years following portfolio formation. This may indicate that positive returns of value stocks are from their positive earnings surprises, while negative returns of glamour stocks are from their negative earnings surprises. They also find that the return differential between value stocks and glamour stocks are smaller in large stocks than in small stocks, consistent with the notion that large stocks about which more information is available are less susceptible to mis-pricing than small stocks.

Lo and MacKinly (1990) and Kothari et al. (1995) suggest that the return differential may be due to research design induced biases. Amihud and Mendelson (1986) suggest the return differential may be due to market frictions.

Dechow and Sloan (1997) finds no systematic evidence that stock prices reflect investors' naive extrapolation of past growth in earnings and sales. Instead, they find half of the returns to contrarian strategies can be explained by investors' naïve reliance on analysts' growth forecasts. In sum, there is not a consensus or the best theory on explanations for the return differentials between value stocks and glamour stocks, yet.

As Xu et. al. (2006) suggest, earnings restatements due to accounting irregularities may increase the uncertainty of the reporting entity because they usually cause class action lawsuits, management shuffle, restructuring, and even bankruptcy. And earnings restatements may impair the information quality of the reporting entity because restating firm's information may not be as reliable to investment public as it used to be prior to the earnings restatement. These higher uncertainty and lower information quality due to earnings restatements increase the risk premium and stock return volatility of the restating firms (See Aboody (2005), Francis (2005), and Li (2005)). Since the magnitude of changes in uncertainty and information quality due to earnings restatements may vary across firms with different firm characteristics, especially between value firms and glamour firms, the market may react to earnings restatements of value firms differently than those of glamour firms.

Thus, it is a valuable research to examine short-term stock price responses to earnings restatements due to accounting irregularities of value firms vis a vis glamour firms[1] as a way of addressing the issue of the return differentials between value firms and glamour firms, which is the purpose of this study.

It is hypothesized that prices of value stocks drop more than those of glamour stocks at the announcement of earnings restatements, if other things being equal. Empirical results of this study show that there are significantly negative Cumulative Abnormal Returns (CAR) over (-1, +1) window and (-5, +5) window surrounding the announcement of earnings restatements. And the short-term impact of earnings restatement announcements on stock prices seems to fade away by the day 1 after the announcement. The results also suggest that CAR do not vary with value/glamour identifiers such as BM, CP, and GS. In order words, CAR of value firms are not significantly different from those of glamour firms around the announcement of earnings restatements.

The remainder of this paper is organized as follows. Development of a testable hypothesis is discussed in the next section that is followed by selection of sample firms and their data. Methodology and measurement of variables are discussed in the third section. And discussions on the empirical tests and their results are followed. Conclusions are addressed in the final section.

## HYPOTHESIS DEVELOPMENT

Value firms usually report higher actual earnings than their expected earnings at the initial announcement of actual earnings immediately prior to the earnings restatement, while glamour firms report lower actual earnings than their expected earnings possibly due to extrapolation of the past trend by rational but naïve investment public. However, both value firms and glamour firms report lower restated earnings than their initial actual earnings at the announcement date. Thus, investment public would realize that upward price adjustments of value stocks at the initial actual earnings announcement was unwarranted and hence should make downward price adjustments with earnings restatements. They would also realize that downward price adjustments to glamour stocks at the initial actual earnings announcements was not enough and hence should make further downward price adjustments with earnings restatements. If investment public perceives a change from a negative belief on a firm value to a more negative belief (Glamour stocks) less strongly than it does a change from a positive belief to a negative belief (Value stocks), market would drop the price of value stocks more than that of glamour stocks at the announcement of earnings restatements. Another way to explain the differential market reactions to earnings restatements of value firms versus glamour firms would be as follows. For a risk averse investor whose utility function increasingly decreases with a loss and decreasingly increase with a gain, a unit of value loss due to stock price decline from lower investment value point would be more painful than that from a higher investment value point. And hence the market with full of risk averse investors would react to a unit of value loss due to stock price decline from lower investment value point more significantly than that from a higher investment value point. Since investment in value stocks, under-priced stocks, do usually have lower value than investment in glamour stocks, over-priced stocks, do, negative earnings surprises due to accounting irregularities would decrease value stock prices more than glamour stock prices. Another plausible reasoning for the differential market reactions to earnings restatements of value stocks versus glamour stocks would be as follows. Since value stocks which have poor operational performances tend to have much slimmer margin of viability and hence closer to falling into bankruptcy than glamour stocks which have good operational performances do, the market would penalize the bad news about value stocks more severely than the same bad news about glamour stocks. Thus, value stock prices would drop more than glamour stock prices at the announcement of earnings restatements due to accounting irregularities. If other things being equal, a testable hypothesis herefrom would be

***Hypothesis**: Ceteris Paribus, prices of value stocks drop more than those of glamour stocks at the announcement of earnings restatements.*

This hypothesis may appear to be inconsistent with previous findings on contrarian investment theory, suggesting that value stocks fall less after negative earnings surprises relative to glamour stock, while value stocks rise more after positive earnings surprises relative to glamour stocks. These are rational reactions of the capital market to earnings surprises for the following reasons. First, negative earnings surprises of glamour stocks are more surprising to the market than those of value stocks are, while positive earnings surprises of value stocks are more surprising than those of glamour stocks are. Second, the market reacts to the more surprising information in larger magnitude than to the less surprising information. Extending this reasoning to earnings restatements due to accounting irregularities, negative information (downward earnings restatements due to accounting irregularities) about value stocks which performed better than expected with initial actual earnings announcements is more alarming to the market than the same information about glamour stocks which performed worse than expected. Thus, value stocks fall more than glamour stocks do with earnings restatements due to accounting irregularities.

## SAMPLE DESCRIPTIONS

A list of earnings restatements due to accounting irregularities announced during January 1997 through December 2002 is obtained from General Accounting Office (GAO). According to GAO's (2002) report, it is the most comprehensive sample during that period and contains 919 earnings restatements announced by 845 public companies. The accounting and stock returns data are drawn from COMPUSTAT and CRSP, respectively. The sample period almost covers the stock market run-up during the late 1990s and its collapse after March 2000. It is the period when the number and magnitude of earnings restatement surge to historic high, providing us a large number of observations. In this period, the public concern on corporate governance grew, leading to the passage of Sarbanes-Oxley Act in July 2002. We exclude earnings restatements announced by American Depository Receipts (ADRs) firms because they are subject to different supervisory requirements.

Comparisons between characteristics of the restating firms and those of all COMPUSTAT firms are presented in Table 1. To measure the statistical significance of the difference between restating firms and all firms, a nonparametric test called Wilcoxon test was conducted because the test avoids the problems caused by skewness and outliers. Since earnings restatements are unevenly distributed across industries (Beasley et al., 2000) and the average size, Book to Market (BM) ratio, and leverage vary from industry to industry, it might be more meaningful to use the industry-adjusted indicators. Industry-adjusted variables are calculated by subtracting the industry median value from the raw value of the variables. We identify companies in the same industry by matching their 4-digit historical SIC codes in the fiscal year when earnings restatement was announced. The reason to use the historical SIC code rather than the current SIC code is that some firms might change their industry after the sample period, making current SIC code an imprecise proxy for industry sector in the sample period. The earlier the event day, the more severe the problem is.

Table 1 show that the raw BM ratios of restating firms are lower than those of all firms in 5 out of 6 sample years (1997, 1998, 1999, 2001, & 2002) and the entire sample period. But the differences are not statistically significant in any year. The industry adjusted-BM ratios of restating firms, however, are higher than the industry means in all 6 testing years. And the differences are statistically significant in 3 out of 6 sample years (1999, 2000, & 2002) and the whole sample period. This discrepancy may suggest that restating firms concentrate in industries with more growth opportunities (the lower BM ratio than the overall) but they have less growth opportunities or are considered riskier than their peers (higher BM ratios than the industry mean).

Restating firms are larger in size: the mean market value of the restating firms is significantly larger than that of all COMPUSTAT firms in 5 out of 6 sample years (1998, 1999, 2000, 2001, & 2002) and the whole sample period. Our result is different from the previous results suggesting that restating firms concentrate in small firms (e.g., Beasley et al., 2000). This discrepancy might be due to a significant increase in the number of large restating firms during the sample period. The industry-adjusted market value of the restating firms are significantly higher than zero in 5 out of 6 sample years (1998, 1999, 2000, 2001, & 2002) and the whole sample period, indicating that restating firms are larger than their peers in the same industry.

Restating firms also have a lower leverage in terms of the ratio of total debt to total assets but the difference is significant in year 1997 and for the whole sample period, only, indicating restating firms have lower leverage ratios than all COMPUSTAT firms. And the industry-adjusted leverage is significantly higher than zero in 5 out of 6 years (1997, 1998, 1999, 2000, & 2001) and the whole sample period, indicating that restating firms do have higher leverage ratios than the industry average.

Some companies restated the same financial statement more than once, making the second announcement less informative. To reduce this noise, only the first announcement in the sample is kept if a company announces restatement more than once within the same fiscal year. To isolate the effect of earnings restatement from other factors, companies that announce earnings figure or guidance, or bankruptcy over the (-5, 5) event-date window are excluded. The information on earnings or earnings guidance announcement and bankruptcy announcement is collected from the U.S. news in the Factiva database around the event day of each firm. Stocks selling below one dollar (so-called penny stocks) before earnings restatement are excluded because they have wide bid-ask spreads, high commissions, low liquidity (Conrad and Kaul, 1993) and higher delisting risks. After these procedures, the final sample includes 542 restating firms with 919 earnings restatements due to accounting irregularities.

| Table 1: Descriptive Statistics of Restating Firms and All COMPUSTAT Firms | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Panel A Book-to-market ratio** | | | | | | | | |
| Year | N1 | Restating firms | N2 | All firms | Diff | z-stat | Industry Adjusted | t-stat |
| 1997 | 61 | 0.572 | 33032 | 0.648 | -0.076 | -0.71 | 0.153 | 1.95 |
| 1998 | 70 | 0.502 | 32633 | 0.772 | -0.27 | -1.79 | 0.023 | 0.54 |
| 1999 | 122 | 0.694 | 31348 | 1.009 | -0.315 | -1.78 | 0.153 | 2.43* |
| 2000 | 155 | 0.983 | 31629 | 0.854 | 0.129 | 1.15 | 0.271 | 4.05** |
| 2001 | 173 | 1.514 | 30032 | 1.837 | -0.323 | -1.64 | 0.371 | 1.75 |
| 2002 | 91 | 1.382 | 27145 | 1.774 | -0.392 | -0.15 | 0.353 | 2.06* |
| Total | 672 | 1.004 | 185819 | 1.145 | -0.141 | -0.35 | 0.249 | 3.89** |
| **Panel B Market value (Million dollars)** | | | | | | | | |
| Year | N1 | Restating firms | N2 | All firms | Diff | z-stat | Industry Adjusted | t-stat |
| 1997 | 64 | 550.8 | 36827 | 1034.13 | -483.33 | -0.94 | 379.02 | 1.81 |
| 1998 | 70 | 2450.27 | 36857 | 1292.68 | 1157.59 | 0.7 | 2366.71 | 2.26* |
| 1999 | 128 | 2234.65 | 36404 | 1566.89 | 667.76 | 2.99** | 1737.54 | 2.06* |
| 2000 | 166 | 1935.09 | 37222 | 1902.6 | 32.43 | 2.15* | 1815.02 | 2.07* |
| 2001 | 183 | 2796.24 | 35970 | 1580.11 | 1216.13 | 7.98** | 2601.81 | 4.09** |
| 2002 | 92 | 2695.2 | 33886 | 1496.68 | 1198.52 | 5.74** | 1716.04 | 2.16* |
| Total | 703 | 2230.89 | 217166 | 1484.35 | 746.54 | 8.44** | 1921.11 | 5.66** |
| **Panel C Total debt / Total asset** | | | | | | | | |
| Year | N1 | Restating firms | N2 | All firms | Diff | z-stat | Industry Adjusted | t-stat |
| 1997 | 64 | 0.33 | 40002 | 0.513 | -0.184 | 3.11** | 0.107 | 4.10** |
| 1998 | 71 | 0.234 | 39410 | 0.386 | -0.152 | -0.18 | 0.661 | 3.17** |
| 1999 | 132 | 0.309 | 40310 | 0.486 | -0.177 | 0.47 | 0.116 | 3.66** |
| 2000 | 167 | 0.281 | 40616 | 0.601 | -0.32 | 0.46 | 0.947 | 4.11** |
| 2001 | 192 | 0.269 | 37973 | 0.9 | -0.63 | 0.65 | 0.52 | 3.52** |
| 2002 | 96 | 0.132 | 34591 | 0.281 | -0.149 | 0.84 | 0.342 | 1.55 |
| Total | 722 | 0.283 | 232902 | 0.685 | -0.402 | 2.10* | 0.779 | 7.87** |

N1 = the number of restating firms with non-negative value,
N2= the number of all COMPUSTAT firms with non-negative value,
Diff = the difference between the median (mean) of the restating firms and those of all the COMPUSTAT firms.
*, and ** = statistical significance at the 5% and 1% levels, respectively, using a 2-tail test.

To examine the effect of mergers and acquisitions of sample firms on their earnings restatements and hence stock returns, reasons for restatements are classified and presented in Table 2. There are only 55 earnings restatements due to mergers and acquisitions out of total 919 earnings restatements, which account for 6 %. And hence mergers and acquisitions are not a major cause of earnings restatements.

**Table 2: Reasons for Restatement (by Incidents)**

| Reasons for Restatement | Incidents | Percentage (%) |
|---|---|---|
| Revenue recognition | 349 | 38 |
| Cost or expense related | 144 | 15.7 |
| Others | 131 | 14.3 |
| Restructuring, assets, or inventory | 82 | 8.9 |
| Mergers and Acquisitions | 55 | 6 |
| Securities related | 50 | 5.4 |
| Reclassifications | 47 | 5.1 |
| In-process research and development related | 33 | 3.6 |
| Related-party transactions | 28 | 3 |
| Total | 919 | 100 |

## METHODOLOGY AND MEASUREMENT OF VARIABLES

Abnormal returns or cumulative abnormal returns (CAR) around the announcement of earnings restatement are estimated to measure the stock price reaction to restatement announcements. Corhay and Rad (1996) show that since stock returns series generally exhibit time-varying volatility, a market model accounting for generalized autoregressive conditional heteroskedastic (GARCH) effects produces more efficient estimators of abnormal returns than a market model estimated using the ordinary least squares (OLS) method. Thus, we used the market model accounting for generalized autoregressive conditional heteroskedastic (GARCH (1, 1)) technique to estimate the abnormal returns during the (-7, +7) event day windows. The model parameters are estimated using the data from 250 to 50 days before the earnings restatement announcement. CAR is the sum of the abnormal returns during the event window.

Like Lakonishok et al.'s (1994), we use the book-to-market (BM) ratio, the cash flow-to-market value (CP) ratio, and the past sales growth (GS) as proxies for the glamour/value characteristics. Glamour stocks are usually stocks with low BM, low CP, and/or high GS, whereas value stocks are usually stocks with high BM, high CP, and/or low GS.

In the univariate test, we divided the sample stocks into five categories by their glamour/value characteristics and compare their average abnormal returns upon restatement announcements. To divide the sample stocks into five categories, a universe of stocks are sorted in ascending order into five deciles at the end of each year by a proxy for the glamour/value characteristics mentioned earlier; we then fit the sample stocks into the five deciles by the proxy. Our universe of stocks consists of all the stocks listed on the NYSE, ASE, and NASDAQ, except for real estate investment trusts (REITs), ADRs, closed-end funds, unit investment, and trusts.

To rank the stocks by the past sales growth, we first calculate the sales growth of all the stocks over the five years prior to the year when the universe stocks were formed; we then calculate the weighted average sales growth of each stock, giving the weight of 5, 4, 3, 2, 1 to its growth in year -1, -2, -3, -4, -5, respectively. We then divide the weighted average sales growth by the number of years that the stock has continuous sale growth. The average past sales growth of new stocks might be inaccurate because they have very few past sales figures. To rule out the influence of new stocks, we require that all the stocks should have sales during the two years prior to the formation year. Stocks falling in decile 1 (5) in the year when earnings restatement is announced have high (low) past sales growth and hence are glamour (value) stocks. If the hypothesis holds, then the stocks in decile 1 should have lower negative CAR than those in declie 5 around the announcement of earnings restatements.

Lakonishok et al. (1994) suggest a two-way classification is a better method to identify value stocks and glamour stocks than a one-way classification. Thus, we also use the combination of BM ratio and past earnings/sales growth to identify the restating firm's glamour/value stock characteristics. At the end of each year, the universe stocks are independently sorted in ascending order into three groups – (1) bottom 30 percent, (2) middle 40 percent, and (3) top 30 percent – by the raw BM ratio and GS, and then take intersections resulting from the two classifications. Restating firms in the low (high) BM high (low) GS group at the end of the year prior to the earnings restatement are glamour (value) stocks. We also use the combination of CP ratio and GS to identify value stocks and glamour stocks.

It has been widely evidenced that there is a positive relationship between earnings surprises and stock price changes and hence abnormal stock returns; i.e., a negative earnings surprise (an excess of the expected earnings over the actual earnings) decreases the stock prices and hence stock returns, while a positive earnings surprise (an excess of the actual earnings over the expected earnings) increases the stock price. And the larger the earnings surprises, the larger stock price changes and abnormal stock returns. (See Beaver et al. (1979))

The following multivariate regression model is estimated to control for the effect of magnitude of earnings restatement on CAR.

$$CAR_{it} = \alpha + \beta_1 MAG_{it} + \beta_2 BM_{it} + \epsilon_t \quad (1)$$

where $CAR_{it}$ denotes the cumulative abnormal return on firm i over the (-1,1) window; $MAG_{it}$, the restatement magnitude of firm 'i' is the cumulative net change in the firm's net income due to earnings restatement scaled by the shareholders' equity at the end of the quarter prior to the restatement. $BM_{it}$ is the book-to-market ratio. We do not add interactive term (the product of the restatement magnitude and BM) because the correlation between these two independent variables is insignificant. The next, we replaced the BM ratio with the CP ratio and GS, respectively, as a proxy for the glamour/value characteristics and redo the multivariate tests. Although the inclusion of restatement magnitude can improve the explanatory power, it decreases the degree of freedom because there are only 202 observations for restatement magnitude data. Because firms restate financial results in different categories and tax data is not available for some companies, only 202 observations have enough data to compute the restatement magnitude.

In order to control for the influence of MAG and other unknown variables on CAR, we run a two step regression where error terms from the following regression model are regressed over the value/glamour identifiers such as BM and CP.

$$CAR_{it} = \alpha + \beta\ MAG_{it} + \epsilon_t \qquad (2)$$

where $CAR_{it}$ and $MAG_{it}$ are the same as those in regression (1).

The regression model for the error terms from the equation (2) over glamour/value stock identifiers would be as follow:

$$RES_{it} = \alpha + \beta_1\ BM_{it} + \epsilon_t \qquad (3)$$

$$RES_{it} = \alpha + \beta_1\ CP_{it} + \epsilon_t \qquad (3')$$

Where BM = the book to market value ratio,
CP = the cash flow to market value ratio.

## EMPIRICAL RESULTS

To control for time-varying volatility of stock returns, a market model adjusted for generalized autoregressive conditional heteroskedastic (GARCH (1, 1)) technique is used to estimate abnormal returns. Results from the model are presented in Table 3. The GARCH-adjusted average CAR are -7.42 percent and -8.96 percent in (-1, 1) and (-5, 5) windows, respectively, both of which are statistically significant. None of daily abnormal returns are statistically significant from the day 2 after the announcement of restatements in terms of the standardized cross-sectional (SCS) test (t-statistic) and the generalized sign test (Z-statistic). In sum, the results in Table 2 suggest that there are significantly negative CAR around the announcement of earnings restatements, consistent with previous studies on association between earnings surprises and abnormal stock returns. (See Beaver, Clarke, and Wright (1979)) And the short-term impact of earnings restatement announcements on stock prices seems to fade away by the day 1 after the announcement. Thus, it is reasonable to use CAR for (-1, +1) window to examine differential market reactions to earnings restatements of value stocks vs. glamour stocks.

**Table 3: GARCH-Adjusted Abnormal Returns around Earnings Restatement Announcements**

| Day | Obs. | Mean Abnormal Return (%) | Median Abnormal Return (%) | Positive: Negative | t-stat | Generalized Sign Z |
|---|---|---|---|---|---|---|
| -7 | 517 | -0.58 | -0.25 | 230:287 | -2.640** | -1.207 |
| -6 | 517 | 0.09 | -0.12 | 246:271 | 0.388 | 0.203 |
| -5 | 517 | -0.42 | -0.36 | 224:293 | -1.878 | -1.735 |
| -4 | 517 | -0.16 | -0.41 | 221:296 | -0.715 | -2.000* |
| -3 | 517 | -0.93 | -0.46 | 204:313 | -4.187*** | -3.497*** |
| -2 | 516 | -0.2 | -0.12 | 241:275 | -0.913 | -0.196 |
| -1 | 515 | -0.25 | -0.19 | 239:276 | -1.118 | -0.331 |
| 0 | 510 | -2.9 | -0.94 | 204:306 | -13.128*** | -3.229** |
| 1 | 505 | -4.38 | -1.48 | 187:318 | -19.798*** | -4.550*** |
| 2 | 507 | 0.07 | -0.18 | 239:268 | 0.294 | 0.002 |
| 3 | 507 | 0.15 | -0.13 | 241:266 | 0.665 | 0.18 |
| 4 | 506 | -0.08 | -0.33 | 233:273 | -0.366 | -0.491 |
| 5 | 507 | 0.01 | -0.17 | 240:267 | 0.032 | 0.091 |
| 6 | 508 | 0.04 | -0.09 | 243:265 | 0.16 | 0.315 |
| 7 | 508 | -0.24 | -0.22 | 239:269 | -1.065 | -0.04 |
| | | CAR | | | | |
| (-1, +1) | 515 | -7.42 | -3.54 | 167:348 | -9.750*** | -6.687*** |
| (-5, +5) | 517 | -8.96 | -3.99 | 190:327 | -8.723*** | -4.731*** |

Abnormal returns = the difference between the actual return and the predicted returns calculated by the GARCH-adjusted market model.
Obs = the number of sample firms.
* and ** = statistical significance at 5% & 1%, respectively using a 2-tail test.

To see if there is any difference in behavior of CAR between bull market years (1997 to 1999) and bear market years (2000-2002), the GARCH adjusted average CAR for testing periods of the bull market years are computed and presented on Table 4, while the CAR of the bear market years on Table 5. The GARCH-adjusted average CAR for the bull market years are -6.92 percent and -7.78 percent in (-1, 1) and (-5, 5) windows, respectively, both of which are statistically significant at 1 % level. The GARCH-adjusted average CAR for the bear market years are -7.79 percent and -9.85 percent in (-1, 1) and (-5, 5) windows, respectively, both of which are also statistically significant at 1 % level. None of daily abnormal returns are statistically significant from the day 2 after the announcement of restatements for both bull and bear market years. In sum, the results presented in Table 4 for the bull market years and Table 5 for the bear market years are consistent with results in Table 3 for the entire sample years: i.e., there are significantly negative CAR on the date of restatement announcements and one day after.

**Table 4: GARCH-Adjusted Abnormal Returns around Earnings Restatement Announcements for the sub-sample period: Jan. 1997 – Mar. 2000**

| Day | Obs. | Mean Abnormal Return (%) | Median Abnormal Return (%) | Positive: Negative | t-stat | Generalized Sign Z |
|---|---|---|---|---|---|---|
| -7 | 214 | -0.56 | -0.23 | 95:119 | -1.134 | -1.296 |
| -6 | 214 | 0.11 | -0.1 | 102:112 | 0.269 | 0.637 |
| -5 | 214 | -0.41 | -0.35 | 93:121 | -1.691 | -1.542 |
| -4 | 214 | -0.14 | -0.39 | 91:123 | -0.842 | -1.066 |
| -3 | 214 | -0.9 | -0.43 | 84:130 | -1.153 | -3.497*** |
| -2 | 213 | -0.18 | -0.1 | 99:114 | -3.133*** | -0.196 |
| -1 | 213 | -0.19 | -0.13 | 98:114 | -0.978 | -0.331 |
| 0 | 210 | -2.92 | -0.96 | 83:124 | -9.947*** | -2. 975** |
| 1 | 203 | -4.35 | -1.45 | 75:127 | -13.674*** | -5.046*** |
| 2 | 204 | 0.09 | -0.16 | 96:108 | 0.638 | 0.047 |
| 3 | 204 | 0.18 | -0.1 | 97:107 | 0.863 | 0.894 |
| 4 | 203 | -0.06 | -0.31 | 93:110 | -0.954 | -0.847 |
| 5 | 204 | 0.02 | -0.16 | 97:107 | 0.019 | 0.185 |
| 6 | 205 | 0.06 | -0.07 | 98:107 | 0.635 | 0.853 |
| 7 | 205 | -0.23 | -0.21 | 96:109 | -0.932 | -0.053 |
| | | CAR | | | | |
| (-1, +1) | 213 | **-6.92** | -3.21 | 93:119 | -8.532*** | -5.753*** |
| (-5, +5) | 214 | **-7.78** | -3.37 | 95:117 | -7.753*** | -4.136*** |

Abnormal returns = the difference between the actual return and the predicted returns calculated by the GARCH-adjusted market model.
Obs = the number of sample firms.
*, ** and *** = statistical significance at 10%, 5% & 1%, respectively using a 2-tail test.

| Table 5: GARCH-Adjusted Abnormal Returns around Earnings Restatement Announcements for the sub-sample period: Apr. 2000 – Jun. 2002 | | | | | | |
|---|---|---|---|---|---|---|
| Day | Obs. | Mean Abnormal Return (%) | Median Abnormal Return (%) | Positive: Negative | t-stat | Generalized Sign Z |
| -7 | 303 | -0.59 | -0.26 | 135:168 | -2.832** | -1.436 |
| -6 | 303 | 0.08 | -0.13 | 144:159 | 0.388 | 0.424 |
| -5 | 303 | -0.43 | -0.37 | 131:172 | -1.578 | -1.386 |
| -4 | 303 | -0.17 | -0.42 | 130:173 | -1.046 | -2.304* |
| -3 | 303 | -0.95 | -0.48 | 120:183 | -5.327*** | -4.064*** |
| -2 | 303 | -0.21 | -0.13 | 142:161 | -1.058 | -0.296 |
| -1 | 302 | -0.29 | -0.23 | 140:162 | -0.903 | -0.572 |
| 0 | 300 | -2.89 | -0.93 | 120:180 | -14.735*** | -3.858** |
| 1 | 302 | -4.4 | -1.5 | 111:190 | -18.858*** | -4.958*** |
| 2 | 303 | 0.06 | -0.19 | 143:160 | 0.578 | 0.043 |
| 3 | 303 | 0.13 | -0.15 | 144:159 | 0.365 | 0.898 |
| 4 | 303 | -0.09 | -0.34 | 140:163 | -0.735 | -0.459 |
| 5 | 303 | 0 | -0.18 | 143:160 | 0.174 | 0.171 |
| 6 | 303 | 0.03 | -0.1 | 145:158 | 0.016 | 0.585 |
| 7 | 303 | -0.25 | -0.23 | 143:160 | -0.965 | -0.073 |
| | | CAR | | | | |
| (-1, +1) | 302 | -7.79 | -3.63 | 167:348 | -9.960*** | -7.001*** |
| (-5, +5) | 303 | -9.85 | -4.74 | 190:327 | -8.683*** | -4.938.*** |

Abnormal returns = the difference between the actual return and the predicted returns calculated by the GARCH-adjusted market model.
Obs = the number of sample firms.
*, ** and *** = statistical significance at 10%, 5% & 1%, respectively using a 2-tail test.

Average CAR and restatement magnitude of five subgroups sorted by BM, CP, and GS are presented in Panels A, B, C of Table 6, respectively. Restating firms in all sub groups show negative MAG, indicating that restated earnings are lowed than the initial actual earnings preceding the restatement. They also show negative CAR, again. However, there are no significantly different CAR between any two subgroups except the difference between subgroups 1 & 3 sorted by BM and the difference between subgroups 3 and 5 sorted by GS. This indicates that CAR may not vary with any of value/glamour identifiers. These findings imply that the capital market does not react to earnings restatements of value firms differently than to those of glamour firms, inconsistent with the hypothesis.

| Table 6: Mean Comparisons between Groups Sorted by One-Way Classification Method | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Panel A. Sample stocks grouped by BM ratio** | | | | | | | | | |
| | Group 1 (Growth) | Group 2 | Group 3 | Group 4 | Group 5 (Value) | | t-stat (1 & 3) | t-stat (3 & 5) | t-stat (1 & 5) |
| Obs. | 90 | 79 | 101 | 87 | 123 | | | | |
| MAG | -7.21 | -2.32 | -4.69 | -5.91 | -7.03 | | | | |
| CAR | -7.13 | -4.83 | -9.13 | -6.71 | -8.07 | | 1.69* | 0.70 | 0.18 |
| **Panel B. Sample stocks grouped by CP ratio** | | | | | | | | | |
| | Group 1 (Growth) | Group 2 | Group 3 | Group 4 | Group 5 (Value) | | t-stat (1 & 3) | t-stat (3 & 5) | t-stat (1 & 5) |
| Obs. | 86 | 97 | 93 | 79 | 87 | | | | |
| MAG | -6.85 | -4.62 | -3.44 | -5.09 | -7.95 | | | | |
| CAR | -7.31 | -4.48 | -9.53 | -6.91 | -8.12 | | 0.39 | 0.85 | 0.18 |
| **Panel C. Sample stocks grouped by GS** | | | | | | | | | |
| | Group 1 (Growth) | Group 2 | Group 3 | Group 4 | Group 5 (Value) | | t-stat (1 & 3) | t-stat (3 & 5) | t-stat (1 & 5) |
| Obs. | 82 | 89 | 84 | 67 | 91 | | | | |
| MAG | -7.47 | -3.95 | -4.79 | -4.03 | -7.12 | | | | |
| CAR | -5.91 | -5.61 | -8.93 | -7.52 | -7.4 | | 0.63 | 1.82* | 0.95 |

Obs = the number of firms in each subgroup.
MAG = the average magnitude of earnings restatements in each subgroup.
CAR = the average CAR of each subgroup.
*, ** = Statistical significance at the 10% and 5%, respectively.

Average CAR and restatement magnitude of 3 subgroups sorted by the two-way classification method are presented in Table 7. Those statistics of subgroups sorted by BM and GS are presented in Panel A, while those by CP and GS in Panel B of Table 7. The results in table 7 are very similar to those in Table 6 and hence do not support the hypothesis that the market reacts to earnings restatements of value firms more strongly than to those of glamour firms. The results show negative MAG and CAR in all subgroups, while CAR does not vary with any of value/glamour characteristics. Except that there is a significantly different CAR between subgroups 1 & 3 sorted by BM and GS at 10% level.

**Table 7: Mean Comparisons between Groups Sorted by Two-Way Classification Method**

**Panel A. Sample stocks grouped by both BM and GS**

| | Group 1 (Low BM & High GS) | Group 2 (Middle BM & Middle GS) | Group 3 (High BM & Low GS) | | t-stat (1 & 2) | t-stat (2 & 3) | t-stat (1 & 3) |
|---|---|---|---|---|---|---|---|
| Obs. | 30 | 38 | 81 | | | | |
| MAG | -5.35 | -4.15 | -7.22 | | | | |
| CAR | -5.75 | -5.92 | -8.21 | | 0.56 | 1.36 | 1.69* |

**Panel B. Sample stocks grouped by both CP and GS**

| | Group 1 (Low CP & High GS) | Group 2 (Middle CP & Middle GS) | Group 3 (High CP & Low GS) | | t-stat (1 & 2) | t-stat (2 & 3) | t-stat (1 & 3) |
|---|---|---|---|---|---|---|---|
| Obs. | 7 | 41 | 67 | | | | |
| MAG | -6.35 | -5.45 | -4.70 | | | | |
| CAR | -6.20 | -5.61 | -7.09 | | 0.92 | 1.57 | 0.91 |

Obs = the number of firms in each subgroup.
MAG = the average magnitude of earnings restatements in each subgroup.
CAR = the average CAR of each subgroup.
*, ** = Statistical significance at the 10% and 5%, respectively

**Table 8: Regressions of CAR on the glamour/value proxies & the Restating Magnitude**

$$CAR_{it} = \alpha + \beta_1 MAG_{it} + \beta_2 BM_{it} + \epsilon_t \qquad (1)$$

$$CAR_{it} = \alpha + \beta_1 MAG_{it} + \beta_2 CP_{it} + \epsilon_t \qquad (1')$$

**Panel A. Equation (1)**

| Intercept | MAG | BM | Adj. $R^2$ |
|---|---|---|---|
| -6.67 (-4.22**) | 0.03 (0.72) | -0.005 (-0.33) | 0.07 |

**Panel B. Equation (1')**

| Intercept | MAG | CP | Adj. $R^2$ |
|---|---|---|---|
| -5.58 (-5.13**) | 0.03 (0.61) | -0.01 (-0.86) | 0.08 |

$CAR_{it}$ = CAR of firm 'i' in year't'.
MAG = the magnitude of earnings restatements.
BM = the book to market value ratio.
CP = the cash flow to market value ratio.
*, ** = Statistical significance at the 10% and 5%, respectively
( ) = the t-value.

Results from multivariate regression model (1) using value/glamour identifiers (Such as BM and CP) and MAG as independent variables are presented in Table 8. The regression coefficients of BM and CP are –0.005 and –0.01, respectively. But both of them are not statistically significant and hence do not support the hypothesis.

Results from the two step regression are presented in Table 9. The regression coefficients of BM and CP are -0.0071 (p-value = -1.62) and -0.0875 (p-value = -0.86), respectively, both of which are not statistically significant. Thus, these results also do not support the hypothesis.

**Table 9: Regressions of the residual on the glamour/value proxies**

$$RES_{it} = \alpha + \beta_1 BM_{it} + \epsilon_t \quad (3)$$

$$RES_{it} = \alpha + \beta_1 CP_{it} + \epsilon_t \quad (3')$$

| Intercept | BM | CP | Adj. $R^2$ |
|---|---|---|---|
| 0.0023 | -0.0071<br>(-1.62) | | 0.03 |
| 0.0017 | | -0.0875<br>(-0.86) | 0.07 |

RES = the residual of the regression of CAR on restatement magnitude.
BM = the book to market value ratio.
CP = the cash flow to market value ratio.
*, ** = Statistical significance at the 10% and 5%, respectively
( ) = the t-value.

Again, to see if there is any structural difference between the bull market years and the bear market years that cause different market reactions to earnings restatements of value stocks vis a vis glamour stocks, the multiple regression model (1), the two step regression models (2), and (3) are estimated for the bull market years and the bear market years, separately. Results from the multiple regression models are presented in Table 10. The regression coefficients of glamour/value proxies such as BM and CP for the bull market years presented in Panel A & C of Table 10 are negative but not statistically significant, while the regression coefficients of glamour/value proxies such as BM and CP for the bear market years presented in Panel B & D of Table 10 are positive but not statistically significant, not supporting the hypothesis.

**Table 10: Regressions of CAR on the glamour/value proxies & the Restating Magnitude for two sub-sample periods**

$$CAR_{it} = \alpha + \beta_1 MAG_{it} + \beta_2 BM_{it} + \epsilon_t \quad (1)$$

$$CAR_{it} = \alpha + \beta_1 MAG_{it} + \beta_2 CP_{it} + \epsilon_t \quad (1')$$

| | | | |
|---|---|---|---|
| **Panel A. Equation (1) for the sub-sample period form January 1997 to March 2000** | | | |
| Intercept | MAG | BM | Adj. $R^2$ |
| -6.98<br>(-2.12**) | 0.17<br>(0.59) | -0.014<br>(-0.04) | 0.03 |
| **Panel B. Equation (1) for the sub-sample period from April 2000 to June 2002** | | | |
| Intercept | MAG | BM | Adj. $R^2$ |
| -6.16<br>(-4.84**) | 0.08<br>(0.29) | 0.01<br>(0.49) | 0.17 |
| **Panel C. Equation (1') for the sub-sample period form January 1997 to March 2000** | | | |
| Intercept | MAG | CP | Adj. $R^2$ |
| -6.03<br>(-3.75**) | 0.01<br>(0.93) | -0.04<br>(-0.57) | 0.1 |
| **Panel D. Equation (1') for the sub-sample period from April 2000 to June 2002** | | | |
| Intercept | MAG | CP | Adj. $R^2$ |
| -5.26<br>(-2.37**) | 0.03<br>(0.61) | 0.00<br>(0.63) | 0.08 |

BM = the book to market value ratio.
CP = the cash flow to market value ratio.
*, ** = Statistical significance at the 10% and 5%, respectively
( ) = the t-value

Results from the two step regression model for the bull market years are in Panel A of Table 11, while those for the bear market years are in Panel B of Table 11. None of the regression coefficients of BM and CP for both bull market years and bear market years are statistically significant, not supporting the hypothesis that the market reacts to earnings restatements of value firms more strongly than to those of glamour firms.

**Table 11: Regressions of the residual on the glamour/value proxies for two sub-sample periods**

$$RES_{it} = \alpha + \beta_1 BM_{it} + \epsilon_t \quad (3)$$

$$RES_{it} = \alpha + \beta_1 CP_{it} + \epsilon_t \quad (3')$$

| Intercept | BM | CP | Adj. $R^2$ |
|---|---|---|---|
| **Panel A. Regression for the sub-sample from January 1997 to March 2000** | | | |
| 0.007 | 0.011<br>(1.62) | | 0.02 |
| 0.002 | | -0.105<br>(-1.02) | 0.09 |
| **Panel B. Regression for the sub-sample from April 2000 to June 2002** | | | |
| Intercept | BM | CP | Adj. $R^2$ |
| 0.001 | -0.009<br>(-0.82) | | 0.03 |
| 0.002 | | -0.02<br>(-0.53) | 0.03 |

BM = the book to market value ratio.
CP = the cash flow to market value ratio.
*, ** = Statistical significance at the 10% and 5%, respectively
( ) = the t-value.

In sum, results shown in Tables 3, 4, 5, 6, 7, 8, 9, 10, and 11 suggest that, in general, the restating firms experience stock price declines around the announcement of earnings restatements but there is no significant difference in this phenomena between value firms and glamour firms, inconsistent with the hypothesis. These results are robust across different measurement of variables. testing methods, and markets (bull market and bear market).

## CONCLUSIONS

This paper examines short-term stock price responses to earnings restatements due to accounting irregularities of value firms vis a vis glamour firms as a way of addressing the issue of the return differentials between value firms and glamour firms. It was hypothesized that, Ceteris Paribus, prices of value stocks drop more than those of glamour stocks at the announcement of earnings restatements.

Empirical results of this study show that there are significantly negative CAR over (-1, +1) window and (-5, +5) window surrounding the announcement of earnings restatements, suggesting that market perceives earning restatements due to accounting irregularities, negatively. These results are consistent with deep discounts on stocks of companies infringed by so-called stock option backdating scandals in a sense that bad (good) news decrease (increase) the stock prices. Recently hundreds of companies, many of which are high tech growth companies, are under investigations for their misconducts on the date of granting stock options. Those companies may intentionally change the day that the stock options were granted to an earlier date when their stocks were trading at lower prices, potentially allowing company executives to lock in higher profits when they exercise their options. Thus, the stock prices of those companies drop significantly with the release of the information. The short-term impact of earnings restatement announcements on stock prices seems to fade away by the day 2 after the announcement. However, the results do not show that CAR (-1, +1) vary with any value/glamour identifiers such as BM, CP, and GS, which do not support the hypothesis that value stocks have higher negative CAR than glamour stocks do with earnings restatements. This suggests that the market does not perceive earnings restatements of value firms any differently than those of glamour firms. These results are robust across different measurement of variables, testing methods, and markets (bull market and bear market).

## ENDNOTES

1 This study adopts the definition made by GAO (2002), i.e., it is "an instance in which a company restates its financial statements because they were not fairly presented in accordance with generally accepted accounting principles (GAAP). This would include material errors and fraud."

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# SWITCHING OPTIONS AND THE IMPACT ON BUSINESS STRATEGY AND RISK MANAGEMENT

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## ABSTRACT

*Risk management strategies can be impacted by real options embedded in the physical operation of a business. This article explores the impact of switching options on natural gas hedging strategies for an Independent Power Producers (IPP's). The results suggest that the volume uncertainty associated with the switch option of purchased electricity led to the ineffectiveness of most of the natural gas hedges. The results suggest that while hedging natural gas price exposure is intuitively appealing, the volume risk of the switch option can lead to over and under-hedged positions and thus has adverse impacts on hedge accounting and cash flow management. However, the switch option has value and this value should be taken into consideration when making hedging decisions.*

## INTRODUCTION

There were 4,560 Independent Power Producers (IPP's) in the United States in 2006 and account for a substantial amount of the 17.9 percent of all electricity generated by natural gas (The Energy Information Administration, 2006). A common business strategy for IPP's is to make a forward sale of electricity to a utility and purchase the natural gas to generate the electricity on a short-term basis. Operators often prefer to delay the purchase of natural gas because the natural gas generating units have real optionality. The plant operator has the option of delivering to the utility electric power generated from the plant or purchasing electricity from the daily electric power market. The operator compares the heat rate efficiency of the plant (number of million British Thermal Units of natural gas to produce one megawatt of power) and the wholesale price of electric power and delivers whichever is less expensive at the time. This real switching option (See Culp, pp. 312-314) can add value to the generator, but does impact the firm's risk management strategy and hedging decision. The "generate versus purchase" option can lead to over or under hedged positions.

## OBJECTIVE

The objective of this study is to explore the impacts of having the option to switch from delivering electricity generated by natural gas at the plant versus purchasing electricity from the daily electric power market on the effectiveness of the natural gas hedge.

## METHODOLOGY

### Optimal Hedging Through the Use of Minimum Variance Hedge Rations

The theory of hedging as a means of reducing price risk has a long history. (see Johnson (1960), Franckle (1980), Ederington, and Culp and Millar(1999)). The effectiveness of a hedge from an economic perspective depends on the amount of risk reduction obtained through the off-setting hedged position. Since the cash flows of the hedge position rarely completely off-set the cash flows of the hedged item due to the basis risk, the optimal off-setting position may be more or less than the hedged item.

A common approach to matching the cash flows of the hedged position to the hedged item is to determine the minimum variance hedge ratio or more commonly known as the optimum hedge. (see Culp (2001), p.p 53-55) The variance minimizing hedge ratio for equal quantities of the hedged item and the futures contract can be determined by regressing cash price changes to the changes in the futures price and observing the beta coefficient.

### Hedging Given Both Price and Volume Risk

Most minimum variance hedge studies assumed volume was known and constant. Development of the portfolio model of hedging with applications to include both price and volume variability were developed by McKinnon (1967) who states that the greater the volume variability relative to price variability, the smaller will be the optimal forward sale; and, the more negatively correlated the price and volume the smaller will be the forward sale. Other work involving hedging with both volume and price risk were Rolfo (1980), Conroy and Rendleman (1983), and Miller and Kahl (1986).

Volume uncertainty in this study is addressed through the inclusion of a switching option. Switching options are a variation of real options where firm management has flexibility of altering decisions to add value to the firm. Culp ((2001) p. 312) defines a switching option where the management can switch either inputs or outputs during the production process. This type of analysis is common in electric power generation since integrated utilities have a number of options for power generation including nuclear, hydroelectric, natural gas, and fossil fuels. Most of these assets are valued as real options and managed accordingly.

**Methodology for the Natural Gas Price Risk Hedge Given Volume Uncertainty**

This study extends the methodology used by Johnson, (2008 pp. 23-24) to include the value of the switching option.

> "*The simulation incorporated the hypothetical case where an Independent Power Producers (IPP) enters into a forward sales agreement with an electric utility where the IPP will deliver electricity from the Combined Cycle Electric Generating Station on a daily basis. The IPP and electric utility enters into the agreement where the electric utility would purchase 100 Megawatts (MW's) for the on-peak hours. (6 a.m. to 10:00 p.m. Central Pacific Time (C.P.T.)). The plant requires 8,000 million British Thermal Units (MBTU's ) of natural gas per megawatt hour (MWh) of electricity. The IPP would deliver electricity from the plant on the days when the generation cost of the plant is less than the wholesale electric market or purchase electricity from the market, whichever is less. Assume the IPP would purchase electricity from the Into Entergy electric market. Also assume the natural gas can be delivered to the plant at a price equal to the Henry Hub natural gas price. Power price is for the on-peak period 5 days per week (Monday through Friday) for 16 hours per day (6 a.m. to 11:00 p.m., CPT).*
>
> *Assume the IPP routinely forward sells the electricity and subsequently hedges the natural gas price exposure three months prior to delivery using NYMEX natural gas futures. Prior to the delivery month the IPP rolls the natural gas hedge into the prompt month on the last trading day before delivery. Natural gas hedged positions are lifted each day during the month of delivery. The hedge using natural gas futures is assumed to commence at the closing price of the natural gas futures contract on the first trading day of the month for a contract three months out. The quantity of futures contracts will be the equivalent amount of the forecasted natural gas needs. The futures contract settlement price will be the closing price on the last day of trading and then the closing price of the prompt contract for each day during the month of delivery.*
>
> *A simplified version of the futures hedge will be:*
>
> $$\Pi_{f(t+3)} = (P_{f(t+3)} V_{(t+3)}) - (P_{ft} V_{(t+3)})$$
>
> where:
>
> $\Pi_{f(t+3)}$ = Return to the future's position;
> $P_{f(t+3)}$ = Futures price at contract expiration;

$V_{(t+3)}$ = Forecast volume; and
$P_{ft}$ = Initial futures price.

The cash position will compare the next day Into Entergy on-peak power price to the generation cost of the natural gas generator based upon the heat rate and the next day price for natural gas delivered at the Henry Hub. If the price of electricity is lower than the generation cost, the electricity would be purchased and the futures hedge lifted.

The return to the cash position will be the difference between projected cash position at the initiation of the hedge with the actual cost of natural gas purchases during the delivery month. The expected futures cash position will be the natural gas futures price and the forecast volume. Specifically, the return to the cash position:

$$\Pi c_{(t+3)} = (P c_{(t+3)} V_{(t+3)}) - (Pa\ Va)_{(t+3)}$$

where:

$\Pi c_{(t+3)}$ = Return to the cash position;
$P c_{(t+3)}$ = Cash price at when hedge is placed;
$V_{(t+3)}$ = Forecast volume;
Pa = Cash Price of natural gas delivered; and
Va = Volume of natural gas purchased."

## Optimal Hedge Ratios for the Natural Gas Hedge

*A simple regression was performed with the simulated profits from the cash position regressed against the returns of the futures position. The resulting beta coefficient of the futures position was used to determine the optimum hedge ratio (minimum variance) designated as $N_f$, where:*

$$N_f = -\,Cov\,(\Pi c_{(t+3)}, \Pi_{f(t+3)})\,/Var\,\Pi_{f(t+3)}$$

## Model Specification for the Switching Option

The actual cost of natural gas generation $(PaVa)_{(t+3)}$ is impacted by the option to switch to the daily power market. Therefore, the simulation included the option of switching from natural gas generation to the purchase of electricity on each day of delivery. Specification for the switching option is:

$$Min\,[(PaVa)_{(t+3),}\ PC)_{(t+3)}] = If\,[[(PaVa)_{(t+3)} < PC_{(t+3)}, (PaVa)_{(t+3),}\ PC_{(t+3},]$$

where,

$(PaVa)_{(t+3)}$ = Natural gas generation cost per MWh (Heat rate time the natural gas price in MMBTU divided by 1000); and
$PC_{(t+3)}$ = Purchase price of electricity in MWh

**Model Specification Incorporating Optimal Hedges with the Switching Option**

The simulation includes a feedback loop where the predetermined optimal hedges ($N_f$) were incorporated into the model with the switching option:

$$\Pi_{(t+3)} = \Pi c_{(t+3)} + N_f(( P_{f(t+3)} V_{(t+3)})) - (P_{ft} V_{(t+3)})) + \text{Min}\,[(PaVa)_{(t+3)}, PC)_{(t+3)}]$$

where,

$\Pi_{(t+3)}$ = Total return of the optimal hedge including the switching option.

## DATA AND ANALYSIS

The simulation included primary seasonal months for the period July 2001 to January 2006. Natural gas hedges were the same as the seasonal power months. All power forward prices, daily power cash prices, and daily cash natural gas prices were obtained from trading day summaries provided by the Intercontinental Exchange (ICE). The forward power contracts used were Into Entergy Summer (July/August), Winter (January/February), and Spring (March/April) with daily power cash prices being Next Day Into Entergy. Natural gas cash prices were the next day Henry Hub. Futures prices used in the analysis were NYMEX closing prices and obtained from the Federal Energy Regulatory Commission's website data base of natural gas futures prices.

Natural gas hedges were entered into on the first trading day three months prior to the month of delivery. The natural gas hedges continued until the last trading day before the day of delivery and then rolled into the prompt month. During the month of delivery, the natural gas hedges were lifted daily until the last day before delivery and the remaining hedged positions rolled to the next prompt month.

## RESULTS

Optimal hedge ratios were determined across all months, all seasons, individual months, and by individual season. (see Johnson, 2008) "*The hedge analysis across all months gave an optimal hedge ratio of -1.38 (Table 1), meaning that the optimal hedge was 1.38 times expected natural gas* *usage. The hedge analysis across all months had an Adjusted $R^2$ of 0.46 and significant t statistic (-4.85, P = .00006) for the beta coefficient of -1.38".*

**Table 1. Summary of Cash Flows From The Natural Gas Hedge, Physical Natural Gas Purchases Versus Expectations, and Power Purchases, 2001-2006.**

| Month | Hedge | Physical Nat Gas | Purchased Power | Purchased Power Gains | Purchased Power Gains | Nat Gas Price | Power Price |
|---|---|---|---|---|---|---|---|
| | Dollars per MW per Month | | | | $/MWh | $/MMBTU | $/MWh |
| July 01 | -6012 | 5531 | 0 | 0 | 0.00 | 5.19 | 41.85 |
| Aug 01 | -6205 | 6518 | 0 | 0 | 0.00 | 5.22 | 39.17 |
| Jan 02 | -1107 | 2996 | 1461 | 47 | 0.13 | 2.32 | 19.45 |
| Feb 02 | -1742 | 1392 | 0 | 0 | 0.00 | 2.28 | 20.82 |
| Mar 02 | 37 | -677 | 0 | 0 | 0.00 | 3.02 | 26.63 |
| Apr 02 | 2141 | -593 | 1309 | 23 | 23.20 | 3.42 | 31.75 |
| July 02 | -1866 | 1694 | 0 | 0 | 0.00 | 3.00 | 33.87 |
| Aug 02 | -463 | 1458 | 0 | 0 | 0.00 | 3.08 | 28.38 |
| Jan 03 | 2804 | 7645 | 9433 | 1253 | 3.40 | 5.36 | 40.58 |
| Feb 03 | 5577 | 3812 | 11011 | 1063 | 3.32 | 7.38 | 56.88 |
| Mar 03 | 5577 | 3812 | 11011 | 901 | 2.68 | 6.30 | 48.52 |
| Apr 03 | 3699 | 3157 | 5163 | 295 | 0.84 | 5.30 | 42.87 |
| July 03 | -170 | 352 | 0 | 0 | 0.00 | 5.06 | 44.44 |
| Aug 03 | -544 | 1882 | 1270 | 42 | 0.13 | 4.97 | 43.43 |
| Jan 04 | 4271 | 9039 | 9398 | 2274 | 6.46 | 6.08 | 43.10 |
| Feb 04 | 1056 | 6850 | 6693 | 290 | 0.91 | 5.39 | 43.18 |
| Mar 04 | 1483 | 11197 | 11927 | 456 | 1.24 | 5.38 | 41.94 |
| Apr 04 | 1357 | 12278 | 13800 | 827 | 2.35 | 5.71 | 43.38 |
| July 04 | 644 | 600 | 448 | 308 | 0.87 | 5.93 | 50.36 |
| Aug 04 | -1002 | 4186 | 2027 | 138 | 0.39 | 5.43 | 45.91 |
| Jan 05 | -4949 | 18864 | 12244 | 1822 | 5.42 | 6.16 | 44.63 |
| Feb 05 | -4476 | 18588 | 13056 | 966 | 3.02 | 6.09 | 45.75 |
| Mar 05 | -1881 | 13023 | 11264 | 405 | 1.10 | 6.93 | 55.34 |
| Apr 05 | 1119 | 10771 | 11467 | 712 | 2.12 | 7.20 | 56.11 |
| July 05 | -1284 | 4981 | 3921 | 42 | 0.12 | 7.57 | 67.39 |
| Aug 05 | 2708 | -1876 | 0 | 0 | 0.00 | 9.45 | 85.67 |
| Jan 06 | -16626 | 41936 | 19211 | 5468 | 15.53 | 8.76 | 54.58 |

Table 1 summarized the cash flows from the hedged position relative to changes in the expected physical gas cash flows by month. Table 1 also shows the cash flows from purchased power switch option for each month and the average price of natural gas during that month. During the months in 2001 and 2002 natural gas prices were generally lower (less than $5.00/MMBTU) limiting the use of the power switch option. Hedges in 2003-2006 months were of generally higher natural gas price months ($4.97/MMBTU-$9.45/MMBTU). During these months natural gas purchases were less than expected and were largely offset by power purchases.

Table 1 also presents a summary of the value of the switching option both in dollars per MW per month and in average dollars per MWh. Across all months, the switching option was $1.99 per MWh with the highest being $23.20 per MWH in April of 2000. The switching option had very little value during the peak summer months when power prices were at their seasonal peak and natural gas prices usually exhibit their seasonal trough. Winter is somewhat different in that even though power prices are high, natural gas prices are higher relatively due to heating demand. Spring had the most value for the swing option due to higher natural gas prices and seasonally low power prices.

The optimal hedge ratio for all months and the optimal hedge ratios by season were simulated to determine the extent of over or under hedging (Table 2) (see Johnson, 2008, p. 29). Over-hedged positions cash flows were as high as 498.64% of expected natural gas purchases in April of 2002 to as low 7.49% of expected natural gas purchases in March 2002. Over-hedging occurred in six months and under-hedging occurred during 12 months. Nine months resulted in risk increasing hedges meaning the cash flows from the physical positions and the hedged items were positive.

**Table 2. Summary of Percentage Change in Cash Flows from Hedges versus Changes in Cash Flows from the Expected Natural Gas Purchases for Optimal Hedge Ratio Simulations Across All Months, 2001-2006.**

| Month | July 01 | Aug 01 | Jan 02 | Feb 02 | Mar 02 | Apr 02 | July 02 |
|---|---|---|---|---|---|---|---|
| Hedge/Expected Physical | -150.00% | -131.39% | -50.99% | -172.71% | -7.49% | -498.64% | -152.07% |
| | | | | | | | |
| Month | Aug 02 | Jan 03 | Feb 03 | Mar 03 | Apr 03 | July 03 | Aug 03 |
| Hedge/Expected Physical | -43.83% | 50.61% | 201.91% | 161.71% | -66.74% | -39.89% | 65.21% |
| | | | | | | | |
| Month | Jan 04 | Feb 04 | Mar 04 | Apr 04 | July 04 | Aug 04 | Jan 05 |
| Hedge/Expected Physical | 21.28% | 18.28% | 15.25% | 147.94% | -33.03% | -36.20% | -33.23% |
| | | | | | | | |
| Month | Feb 05 | Mar 05 | Apr 05 | July 05 | Aug 05 | Jan 06 | |
| Hedge/Expected Physical | -19.93% | 14.34% | -35.56% | -199.12% | -54.71% | -15.61% | |

## CONCLUSION

The volume uncertainty associated with the switch option of purchased electricity and the volatility of natural gas cash prices during delivery relative to the futures price of the prompt month led to the ineffectiveness of most of the natural gas hedged positions. The results suggest that while hedging natural gas price exposure is intuitively appealing, the volume risk of the switch option can lead to over and under-hedged positions, may preclude one from using hedge accounting, adversely impacts cash flow management, and can even be risk increasing. However, the switch option has value which may offset these inefficiencies and this value should be taken into consideration when making hedging decisions.

While these results are specific to the hedging activities of an IPP, they have broad implications for hedging where volume risk is present.

## SUGGESTIONS FOR FUTURE RESEARCH

The study is limited in scope but does provide insight into the use of real options and hedge effectiveness. The study could be extended to include other risk management strategies that might be more effective in matching the cash flows of the physical position and the hedge such as the use of daily call options rather than futures contracts for the hedge of natural gas.

Independent Power Producers sell into competitive electric power markets and are not subject to state or federal rate setting agencies. Regulated electric utilities that use hedging strategies for their own natural gas generation could have an impact on rate structures since these activities do impact their cost to serve. This type of study could address the needs of rate making authorities.

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# WHAT DOES BOOK-TO-MARKET PROXY: RISK OR INVESTOR SENTIMENT?

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## ABSTRACT

*Debate persists over the long run impacts of systematic risks versus investor sentiment on asset returns (Griffin & Lemmon, 2002; Vassalou & Xing, 2004). At the center of this controversy is the book-to-market ratio, which our study decomposes into three parts. This approach allows us to better investigate whether book-to-market is a proxy for risk factors or investor sentiment. Time-series regression analysis is applied to ten industries over 1934-2003. In contrast to prior research on investor over-/under-reaction, we find the component of book-to-market correlated with investor sentiment has only marginal explanatory power. The component of book-to-market correlated with systematic risks better explains the time variation of industry portfolio returns.*

## INTRODUCTION

There is abundant research documenting the robustness of book-to-market values of equity in explaining stock returns. However, while the explanatory power of the book-to-market 'factor' is generally accepted, there is significant debate over whether the factor is a risk proxy or its significance is the product of mispricing. Risk proxy arguments generally focus on the risk of financial distress, which is presumably greater in small firms and firms with market values of equity that are low relative to their book values. Mispricing arguments usually focus on investor irrationality as captured by over-reaction to past information or extrapolation of past trends too far into the future, both of which produce over- or under-valuations that are ultimately corrected as new information is revealed. Resolving this debate is important because if firm size and book-to-market are indeed proxies of systematic risks, rather than due to mispricing, then using the popular Fama and French (1993) model as an asset pricing model is justified.

Because evidence exists to support both explanations, clearly separating the two potential sources of significance is difficult. However, attempts have been made to test which source dominates. Daniel and Titman (1997) form portfolios based first on book-to-market (B/M) and then on Fama and French's three factors. They find a stronger relation exists between expected return and B/M than between expected return and the three factors. They conclude that B/M has more explanatory power than the factor loadings. Their results support a characteristics-based model, and are consistent with a mispricing story. In contrast to the Daniel and Titman results, Lewellen (1999) shows with a conditional time-series regression analysis that B/M provides no incremental information beyond that which is provided by the Fama-French factors. In other words, Lewellen's approach assumes the Fama-French factors are risk factors and any portion of B/M not correlated to them could be considered something related to investor over-reaction.

Our study builds upon Lewellen's framework by examining the role of investor sentiment vis-à-vis risk factors to explain long run stock returns to industry portfolios. We decompose B/M into three parts – the part correlated with risk factors, the part correlated with investor sentiment, and the part not correlated with either. While Lewellen implicitly assumes that the part of B/M not correlated with risk factors reflects investor sentiment, we investigate whether B/M can be decomposed into three different components as well as the relative importance of each component. We find that B/M's correlation with risks most effectively explains industry portfolio returns over time.

The next section provides an overview of relevant literature. Section three describes the empirical methodology. Section four presents the results. Section five concludes.

## PRIOR RESEARCH

Fama and French (1992) report that both firm size and book-to-market values of equity dominate other variables in explaining the average returns on U.S. stocks. More specifically, leverage and price-to-earnings ratios alone were found to be significant in explaining average monthly returns. Furthermore, these variables remain significant when the firm size variable was included in the model, but when both the size and the B/M ratio were included, the significance of the leverage and the price-to-earnings ratios disappeared. Fama and French concluded that if asset pricing is rational, size and book-to-market must proxy for systematic risk.

The predominant risk-based interpretation for the significance of size and book-to-market is that the variables are proxies for the risk of financial distress. For example, Chan and Chen (1991) find that two-thirds of the firms in the bottom size quintiles fell from higher quintiles due to poorer operating results and higher interest expenses than were experienced by other firms in higher quintiles from the same industry. Similarly, Loughran (1997) reports that the significance of B/M is driven by those firms with poor operating performance during the portfolio formation period: the majority of firms with high B/M tend to experience distress listings. Finally, Fama and French (1995) and Chen and Zhang (1998) show that firms with high B/M have persistently low earnings, higher leverage, more earnings uncertainty, and are more likely to cut dividend payments than other firms.

An alternative interpretation for the significance of size and B/M is that they reflect over-reaction in the market. For example, Chopra, Lakonishok, and Ritter (1992) find that the extreme losers for the prior five years outperform extreme prior winners by 5%-10% per year during the subsequent five years. Chopra *et al*. attribute this phenomenon to investor over-reaction. An interesting finding of Chopra *et al*. is that the over-reaction effect is substantially stronger for smaller firms than for larger firms. Consistent with Chopra *et al*., Kumar and Lee (2005) study the trades of retail investors and find evidence that investor sentiment plays a role beyond the standard risk factors in the returns of small stocks, value stocks, stocks with low institutional ownership, and low-price stocks.

In a similar vein, Lakonishok, Shleifer, and Vishny (1994) posit that the high returns of high B/M firms are due to investors who incorrectly extrapolate the past earnings growth rates of firms. Thus, high (low) growth rates extrapolated into the future produce over-valuations (under-valuations) that are subsequently corrected as actual growth rates are revealed. This implies that small, high (large, low) B/M firms perform better (worse) than the traditional CAPM would suggest. La Porta (1996) and La Porta, Lakonishok, Shleifer, and Vishny (1997) and Dicheve (1998) present empirical evidence consistent with this proposition. Dicheve identifies firms with high bankruptcy risk and finds that these firms have low average stock returns, which is inconsistent with size and B/M being proxies for distress risk.

Griffin and Lemmon (2002) directly test whether book-to-market is a proxy for distress risk or investor over-reaction. Griffin and Lemmon create quintiles using Ohlson's (1980) measure of financial distress. They find that many firms in the highest quintile (highest financial distress) have low B/M values and under-perform, those firms with low B/M under-perform, and premiums for the high B/M firms are no different from those for the high B/M firms in the lower quintiles (less financial distress). They also find that abnormal returns around subsequent earnings announcements are largest for those firms in the highest quintile. The authors interpret their results as indicating investors underestimate the importance of current fundamentals and overestimate future growth.

In contrast, Fama and French (1995) provide evidence suggesting stock prices forecast the reversion in earnings growth observed after firms are ranked on size and B/M and that, consistent with rational pricing, high B/M signals persistent poor earnings while low B/M signals strong earnings. Following in that vein, Vassalou and Xing (2004) posit that most of the default risk models previously used depend on accounting information, which omits important information about default risk, and use Merton's option pricing model to calculate default risk. The authors conclude that default risk is systematic risk, and that size and book-to-market are related to default risk.

## DATA AND METHODOLOGY

The sample period spans 1934-2003. Data for the Fama-French factors (i.e., market factor, size factor, book-to-market factor and momentum factor), as well as value-weighted monthly and annual average returns of 10 industry-defined portfolios, are all generously provided at *Kenneth French's Data Library*. (For variable details, please see: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. Following French, we define 10 industry portfolios as follows: Consumer NonDurables (ind 1), Consumer Durables (ind

2), Manufacturing (ind 3), Oil, Gas, and Coal Extraction and Products (ind 4), Business Equipment (ind 5), Telephone and Television Transmission (ind 6), Wholesale, Retail, and Some Services (ind 7), Healthcare, Medical Equipment, and Drugs (ind 8), Utilities (ind 9), and Other (ind 10).)

To capture investor sentiment, we rely on the comprehensive study and data generously provided by Baker and Wurgler (2006) and follow their methodology, using five measures of a 'sentiment factor' as a check for robustness. (Please see: http://www.afajof.org/afa/all/Investor_Sentiment_Data_Post-1.xls.) Briefly, they develop a composite sentiment index comprised of six other sentiment proxy variables used by various other studies: dividend premiums, IPO volume and first-day returns, closed-end fund discounts, equity issuance as a percentage of new issuances, and NYSE trade turnover. To mitigate the influence of systematic risk on the index, it is also re-formed using orthogonalized factors to account for various macroeconomic conditions. Because data for three of the six component sentiment variables is unavailable before 1962, they also form a sub-index of the composite index using only three variables to conduct analyses from 1935 onwards. Last, the authors note that one of the six component variables, the closed-end fund discount, appears to separately explain several other findings, so we investigate it by itself.

Our five measures then, of an investor sentiment factor are: Sf1, which covers 1934-2003, includes the three available sentiment variables (closed-end fund discount, equity share of new issuances, NYSE turnover), and accounts for macroeconomic conditions; Sf1raw, which is the same as Sf1 but does not correct for macroeconomic events; Sf2, which covers 1962-2003, includes all six sentiment variables, and accounts for macroeconomic conditions; Sf2raw, which is the same as Sf2 but does not correct for macroeconomic events; and Cef, which covers 1962-2003 and contains only the closed-end discount sentiment variable.

Table 1 provides summary statistics of industry monthly returns and investor sentiment variables. Both industry monthly returns and investor sentiment variables show considerable variations during our sample periods.

**Table 1: Summary of industry monthly returns, book-to-market equity and investor sentiment**

| Variable | Mean Return (%) | Std. Dev. (%) Return | Minimum Return (%) | Maximum Return (%) | Mean B/M | Std. Dev. B/M |
|---|---|---|---|---|---|---|
| Consumer NonDurables | 0.994 | 4.843 | -25.2 | 34.01 | 0.619 | 0.222 |
| Consumer Durables | 1.185 | 7.353 | -32.44 | 73.97 | 0.619 | 0.183 |
| Manufacturing | 1.003 | 6.422 | -29.77 | 57.68 | 0.68 | 0.225 |
| Oil, Gas, and Coal Extraction and Products | 1.036 | 5.978 | -26.17 | 33.75 | 0.845 | 0.318 |
| Business Equipment | 1.129 | 7.529 | -33.84 | 51.6 | 0.428 | 0.165 |
| Telephone and Television | 0.862 | 4.802 | -21.56 | 28.16 | 0.851 | 0.368 |

| Table 1: Summary of industry monthly returns, book-to-market equity and investor sentiment | | | | | | |
|---|---|---|---|---|---|---|
| Variable | Mean Return (%) | Std. Dev. (%) Return | Minimum Return (%) | Maximum Return (%) | Mean B/M | Std. Dev. B/M |
| Transmission | | | | | | |
| Wholesale, Retail, and Some Services | 1.011 | 5.993 | -29.9 | 36.88 | 0.54 | 0.166 |
| Healthcare, Medical Equipment, and Drugs | 1.145 | 5.881 | -34.68 | 38.69 | 0.312 | 0.114 |
| Utilities | 0.876 | 5.814 | -33.06 | 43.29 | 1.013 | 0.376 |
| Other | 0.965 | 6.522 | -29.75 | 57.99 | 1.354 | 0.827 |
| Sf1 | 0 | 0.993 | -2.302 | 2.424 | | |
| Sf2 | 0 | 0.989 | -1.94 | 2.636 | | |
| Sf1raw | 0 | 0.993 | -2.428 | 2.335 | | |
| Sf2raw | 0 | 0.989 | -1.798 | 2.327 | | |
| Cef | 10.813 | 8.489 | -10.406 | 29.515 | | |

Industry portfolios are defined as follows: Consumer NonDurables (Ind1), Consumer Durables (Ind2), Manufacturing (Ind3), Oil, Gas, and Coal Extraction and Products (Ind4), Business Equipment (Ind5), Telephone and Television Transmission (Ind6), Wholesale, Retail, and Some Services (Ind7), Healthcare, Medical Equipment, and Drugs (Ind8), Utilities (Ind9), Other (Ind10). The remaining five variables are based on Baker and Wurgler (2006): Sentiment factor 1 (Sf1) is the first principal component of the three available sentiment proxies (closed-end fund discount, equity share in new issues, lagged natural log NYSE turnover (detrended using past five-year average)) using 1934-2003 data where each of the proxies has first been orthogonalized with respect to a set of macroeconomic conditions, which includes industrial production index, growth in consumer durables, non-durables and services, and a dummy variable for NBER-defined recession; Sentiment factor 1 raw (Sf1raw) is the first principal component of the three available sentiment proxies (closed-end fund discount, equity share in new issues, lagged natural log NYSE turnover (detrended using past five-year average)) using 1934-2003 data; Sentiment factor 2 (Sf2) is the first principal component of six (standardized) sentiment proxies over 1962-2003 data, where each of the proxies has first been orthogonalized with respect to a set of macroeconomic conditions; Sentiment factor 2 raw (Sf2raw) is the first principal component of six (standardized) sentiment proxies over 1962-2003 data; Sentiment factor 5 (Cef) is closed-end fund discounts from Neal and Wheatley (1998) for 1962 to 1993, CDA/Wiesenberger for 1994 to 1998, and computed from turn-of-year issues of Wall Street Journal for 1999 onward. Book-to-market (B/M) is the natural log of the value-weighted book-to-market ratio of all firms in the specific industry portfolio where each firm's B/M is the sum of the book equity value at previous year-end divided by total market value of the firm's equity evaluated at previous year-end stock price.

Next, we investigate the correlations between the investor sentiment variables and industry B/M ratios. Table 2 shows that while the degree of correlation varies depending on a particular combination of an investor sentiment variable and an industry's B/M, in most cases the correlation is statistically significant.

| Table 2: Correlation coefficients between book-to-market of equity and sentiment factors | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BM1 | BM2 | BM3 | BM4 | BM5 | BM6 | BM7 | BM8 | BM9 | BM10 |
| sf1 | -0.405 | -0.155 | -0.269 | -0.395 | -0.378 | -0.114 | -0.334 | -0.248 | -0.284 | -0.491 |
| *p value* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| sf2 | -0.094 | -0.008 | 0.032 | -0.094 | -0.165 | 0.056 | -0.039 | 0.036 | 0.144 | -0.38 |
| *p value* | -0.034 | -0.854 | -0.471 | -0.035 | 0 | -0.206 | -0.388 | -0.425 | -0.001 | 0 |
| sf1raw | -0.248 | 0.057 | -0.26 | -0.454 | -0.382 | 0.008 | -0.193 | -0.073 | -0.341 | -0.613 |
| *p value* | 0 | -0.1 | 0 | 0 | 0 | -0.827 | 0 | -0.034 | 0 | 0 |
| sf2raw | -0.095 | 0.035 | 0.082 | -0.011 | -0.086 | 0.067 | -0.013 | 0.104 | 0.191 | -0.331 |
| *p value* | -0.033 | -0.427 | -0.066 | -0.799 | -0.053 | -0.136 | -0.776 | -0.02 | 0 | 0 |
| cef | 0.384 | 0.051 | 0.333 | 0.436 | 0.306 | 0.157 | 0.351 | 0.231 | 0.323 | 0.503 |
| *p value* | 0 | -0.142 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

$BM_i$ is each industry's book-to-market of equity value and is calculated as the natural log of the value-weighted book-to-market ratio of all firms in the specific industry portfolio where each firm's B/M is the sum of the book equity value at previous year-end divided by total market value of the firm's equity evaluated at previous year-end stock price. The five investor sentiment factors (Sf1, Sf2, Sf1raw, Sf2raw, Cef) are defined in table 1.

To begin our analysis, we investigate whether investor sentiment and book-to-market can explain residual stock returns once the Fama-French risk factors are used as control variables. To do so, we run the following model:

$$R_{it}-R_{ft} = a_i + b_i\,(R_{mt}-R_{ft}) + s_i\,(SMB_t) + h_i\,(HML_t) + m_i\,(MOM_t) + f_i\,(SF_t) + a_1\,B/M_{i,t-1} + e_{it} \qquad (1)$$

where i is the industry, t is the month or year, $R_i$ is the value-weighted industry portfolio return, and $R_f$ is the risk-free interest rate as measured by the three-month Treasury bill. $R_{mt}-R_{ft}$ is the CRSP value-weighted market index excess return, SMB is the return to small stocks less the returns to large stocks, HML is the returns to high B/M stocks less the returns to low B/M stocks, MOM is the returns to high momentum stocks less the returns to low momentum stocks, SF is one of our five investor sentiment factors and B/M is the book-to-market of equity at the previous year-end. The significance of $f_i$ and $a_1$ will reveal whether investor sentiment and/or book-to-market of equity, respectively, explain residual returns.

Next, we allow expected returns and all the coefficients in model (1) to vary with B/M, thus forming a conditional regression model by replacing coefficients in the following way:

$$a_i = a_0 + a_1\,B/M_{i,t-1} \quad b_i = b_0 + b_1\,B/M_{i,t-1} \quad s_i = s_0 + s_1\,B/M_{i,t-1}$$
$$h_i = h_0 + h_1\,B/M_{i,t-1} \quad m_i = m_0 + m_1\,B/M_{i,t-1} \quad f_i = (f_0 + f_1\,B/M_{i,t-1}).$$

This allows us to test whether the predictive power of B/M on stock returns comes from its correlation with risks, investor sentiment, or something else. Substituting, we have:

$$R_{it}\text{-}R_{ft} = a_0 + a_1\,B/M_{i,t\text{-}1} + (b_0 + b_1\,B/M_{i,t\text{-}1})(R_{mt}\text{-}R_{ft}) + (s_0 + s_1\,B/M_{i,t\text{-}1})\,(SMB_t)$$
$$+ (h_0 + h_1\,B/M_{i,t\text{-}1})\,(HML_t) + (m_0 + m_1\,B/M_{i,t\text{-}1})\,(MOM_t)$$
$$+ (f_0 + f_1\,B/M_{i,t\text{-}1})\,(SF_t) + e_{it} \qquad (2)$$

Our attention is focused on the significance of $b_1$, $s_1$, $h_1$, $m_1$ and $f_1$. If $b_1$, $s_1$, $h_1$, or $m_1$ is consistently significant, that would indicate that the part of the B/M correlated with systematic risk explains stock returns. In contrast, if $f_1$ is consistently significant, that would indicate that the part of the B/M correlated with investor sentiment has explanatory power of returns. Obviously, both components of B/M can be consistently significant, implying that both the Fama-French risk factors and investor sentiment play a role when B/M explains stock returns.

## RESULTS

Table 3 reports the estimates of $f_1$ for model (1) regression results using monthly excess returns. Panel A is generated using the Seemingly Unrelated Regression (SUR) estimation method because of possible correlation among the error terms of our industry portfolio return regressions. The explanatory power of the different investor sentiment variables is not robust across industries while the estimate for B/M is significant in six of the ten industry return regressions; however, three of the five estimates for the investor sentiment variables are statistically significant for the consumer nondurables industry. Panel B shows the regression results for model (1) using Newey-West's heteroskedasticity and autocorrelation corrected estimation. Compared to the results in panel A, the number of cases where the estimates for the investor sentiment variables exhibit statistical significance decreases from five to four and book-to-market is significant in only two industry return regressions. As in panel A, three of the five estimates for investor sentiment for the consumer nondurable industry are significantly different from zero. To sum, table 3 shows that investor sentiment variables have only marginal explanatory power in monthly industry returns while the significance of B/M varies between two different estimation methods.

**Table 3: Monthly time series regression of residual industry returns on investor sentiment and B/M**

| **Panel A. SUR estimation results** | | | | | | |
|---|---|---|---|---|---|---|
| Industry | cef | sf2 | sf2raw | sf1 | sf1raw | bm |
| Consumer NonDurables | -0.018 | -1.767* | 2.381** | 0.765 | -1.708** | 2.045*** |
| | -0.061 | -1.065 | -0.967 | -0.886 | -0.699 | -0.482 |
| Consumer Durables | -0.074 | -0.895 | 0.665 | -0.286 | -0.175 | 1.313** |
| | -0.075 | -1.303 | -1.169 | -1.09 | -0.749 | -0.565 |

**Table 3: Monthly time series regression of residual industry returns on investor sentiment and B/M**

| | | | | | | |
|---|---|---|---|---|---|---|
| Manufacturing | -0.004 | -1.132 | 1.146 | 0.864 | -1.325** | 1.742*** |
| | -0.065 | -1.139 | -1.025 | -0.935 | -0.686 | -0.454 |
| Oil, Gas, and Coal Extraction and Products | 0.064 | -1.474 | 1.44 | 1.161 | -1.038 | 1.602** |
| | -0.07 | -1.212 | -1.09 | -1.062 | -0.793 | -0.787 |
| Business Equipment | 0.054 | -1.723 | 1.459 | 0.958 | -0.596 | 0.75 |
| | -0.092 | -1.59 | -1.43 | -1.313 | -0.889 | -0.492 |
| Telephone and Television Transmission | -0.039 | -0.557 | 0.713 | -0.803 | -0.015 | 0.744 |
| | -0.067 | -1.165 | -1.066 | -0.969 | -0.792 | -0.459 |
| Wholesale, Retail, and Some Services | -0.07 | -0.99 | 1.082 | -0.073 | -0.477 | 1.273** |
| | -0.073 | -1.269 | -1.142 | -1.047 | -0.787 | -0.561 |
| Healthcare, Medical Equipment, and Drugs | -0.022 | -0.938 | 1.367 | 0.24 | -1.001 | 0.918 |
| | -0.07 | -1.221 | -1.098 | -1.008 | -0.742 | -0.57 |
| Utilities | -0.071 | -0.039 | 0.335 | -1.199 | 0.199 | 0.194 |
| | -0.055 | -0.969 | -0.869 | -0.793 | -0.521 | -0.45 |
| Other | 0.014 | -1.522 | 1.938* | 0.61 | -1.155 | 1.513*** |
| | -0.07 | -1.21 | -1.095 | -0.988 | -0.746 | -0.491 |
| **Panel B. Newey-West estimation results** | | | | | | |
| Consumer NonDurables | -0.019 | -1.732** | 2.282*** | 0.582 | -1.430* | 1.709** |
| | -0.05 | -0.858 | -0.837 | -0.692 | -0.796 | -0.739 |
| Consumer Durables | -0.072 | -0.913 | 0.676 | -0.222 | -0.224 | 1.418 |
| | -0.068 | -1.105 | -1.199 | -1.037 | -0.914 | -0.978 |
| Manufacturing | -0.008 | -1.126 | 1.067 | 0.463 | -0.798 | 0.96 |
| | -0.043 | -0.809 | -0.819 | -0.872 | -0.956 | -0.943 |
| Oil, Gas, and Coal Extraction and Products | 0.064 | -1.472 | 1.435 | 1.127 | -1.004 | 1.543 |
| | -0.056 | -0.968 | -0.868 | -1.06 | -0.931 | -1.109 |
| Business Equipment | 0.055 | -1.729 | 1.465 | 0.992 | -0.619 | 0.797 |
| | -0.074 | -1.258 | -1.365 | -1.214 | -0.903 | -0.801 |
| Telephone and Television Transmission | -0.042 | -0.472 | 0.532 | -1.044 | 0.382 | 0.368 |
| | -0.07 | -1.058 | -1.047 | -1.048 | -0.926 | -0.667 |
| Wholesale, Retail, and Some Services | -0.071 | -0.991 | 1.047 | -0.207 | -0.29 | 1.003 |
| | -0.056 | -1.059 | -1.049 | -0.854 | -0.873 | -0.885 |
| Healthcare, Medical Equipment, and Drugs | -0.025 | -0.861 | 1.291 | 0.472 | -1.288 | 1.388* |
| | -0.058 | -0.88 | -0.88 | -0.941 | -0.829 | -0.782 |
| Utilities | -0.072* | -0.172 | 0.238 | -0.901 | 0.142 | 0.852 |
| | -0.037 | -0.837 | -0.743 | -0.745 | -0.476 | -0.59 |

| Table 3: Monthly time series regression of residual industry returns on investor sentiment and B/M | | | | | | |
|---|---|---|---|---|---|---|
| Other | 0.003 | -1.569 | 1.706 | 0.221 | -0.527 | 0.668 |
| | -0.06 | -1.123 | -1.131 | -0.821 | -0.961 | -0.94 |

*** denotes significance at the 1% level.** denotes significance at the 5% level.* denotes significance at the 10% level. Model is: $R_{it}$-$R_{ft}$ = $a_i$ + $b_i$ ($R_{mt}$-$R_{ft}$) + $s_i$ ($SMB_t$) + $h_i$ ($HML_t$) + $m_i$ ($MOM_t$) + $\sum f_i$ ($SF_t$) + $a_l$ $B/M_{i,t-1}$+ $e_{it}$, where i is the industry, t is the month, $R_i$ is the value-weighted industry portfolio return, and $R_f$ is the risk-free interest rate as measured by the three-month Treasury bill. $R_{mt}$-$R_{ft}$ is the CRSP value-weighted market index excess return, SMB is the return to small stocks less the returns to large stocks, HML is the returns to high B/M stocks less the returns to low B/M stocks, MOM is the returns to high momentum stocks less the returns to low momentum stocks, and SF is one of five investor sentiment factors (Sf1, Sf2, Sf1raw, Sf2raw, Cef) as defined in table 1. Standard error is in parenthesis.

Next, we use SUR to estimate model (1) with annual industry excess returns. Results, reported in table 4, show that the estimate for sf1raw is significant in eight of the ten industry regressions. Only for the telephone and television transmission industry and utilities industry is the sf1raw estimate not significant. These results are nearly as strong as the results for B/M. Table 4 shows that, using annual returns, the estimate for B/M is significant for all ten industries. Based on these robust results for sf1raw, it is a good investor sentiment factor, and we will use it to test model (2).

**Table 4: Annual time series regression of residual industry returns on investor sentiment and B/M: SUR estimation method**

| Industry | cef | sf2 | sf2raw | sf1 | sf1raw | bm |
|---|---|---|---|---|---|---|
| Consumer NonDurables | 0.85 | -22.442* | 26.687** | 25.262** | -27.410*** | 21.181*** |
| | -0.714 | -12.448 | -11.274 | -10.218 | -7.83 | -4.89 |
| Consumer Durables | -0.024 | -4.633 | 2.297 | 20.996 | -23.628** | 32.114*** |
| | -0.974 | -16.937 | -15.213 | -13.837 | -9.478 | -5.569 |
| Manufacturing | 0.021 | -9.492 | 7.461 | 18.418** | -23.775*** | 21.055*** |
| | -0.655 | -11.39 | -10.25 | -9.341 | -6.883 | -4.633 |
| Oil, Gas, and Coal Extraction and Products | 0.221 | -0.079 | -1.052 | 12.581 | -18.101** | 18.528** |
| | -0.849 | -14.732 | -13.253 | -12.402 | -8.975 | -7.352 |
| Business Equipment | 0.932 | -19.359 | 14.162 | 24.477 | -21.387* | 16.480*** |
| | -1.176 | -20.365 | -18.313 | -16.678 | -11.325 | -5.859 |
| Telephone and Television Transmission | 0.554 | -23.08 | 26.783* | 9.715 | -13.021 | 14.420** |
| | -0.964 | -16.819 | -15.416 | -13.971 | -11.545 | -6.838 |
| Wholesale, Retail, and Some Services | 0.662 | -19.22 | 22.275 | 29.528** | -32.926*** | 28.880*** |
| | -0.93 | -16.191 | -14.586 | -13.387 | -10.189 | -7.595 |
| Healthcare, Medical Equipment, and Drugs | 1.368* | -37.594*** | 34.755*** | 31.637*** | -21.970*** | 13.370** |
| | -0.773 | -13.485 | -12.13 | -11.186 | -8.37 | -6.912 |

| Table 4: Annual time series regression of residual industry returns on investor sentiment and B/M: SUR estimation method | | | | | | |
|---|---|---|---|---|---|---|
| Industry | cef | sf2 | sf2raw | sf1 | sf1raw | bm |
| Utilities | 0.59 | -10.623 | 2.48 | 20.667** | -9.747 | 16.053*** |
| | -0.743 | -12.953 | -11.637 | -10.403 | -6.971 | -3.921 |
| Other | 0.622 | -12.917 | 15.868 | 17.959 | -23.770*** | 14.482** |
| | -0.805 | -13.933 | -12.651 | -11.462 | -8.962 | -6.599 |

*** denotes significance at the 1% level.** denotes significance at the 5% level.* denotes significance at the 10% level.
Model is: $R_{it}\text{-}R_{ft} = a_i + b_i\ (R_{mt}\text{-}R_{ft}) + s_i\ (SMB_t) + h_i\ (HML_t) + m_i\ (MOM_t) + \sum f_i\ (SF_t) + a_1\ B/M_{i,t\text{-}1} + e_{it}$, where i is the industry, t is the year, $R_i$ is the value-weighted industry portfolio return, and $R_f$ is the risk-free interest rate as measured by the three-month Treasury bill. $R_{mt}\text{-}R_{ft}$ is the *CRSP* value-weighted market index excess return, SMB is the return to small stocks less the returns to large stocks, HML is the returns to high B/M stocks less the returns to low B/M stocks, MOM is the returns to high momentum stocks less the returns to low momentum stocks, and SF is one of five investor sentiment factors (Sf1, Sf2, Sf1raw, Sf2raw, Cef) as defined in table 1. Only $f_i$ is reported. Standard error is in parenthesis.

In table 5, we estimate model (2) using investor sentiment factor sf1raw to test whether the component of B/M correlated with investor sentiment or the component of B/M correlated with risk factors better explains stock returns. Again SUR is used to estimate the model. Table 5 shows that the components of B/M correlated with the Fama-French risk factors have explanatory power for stock returns, but the interaction between B/M and investor sentiment is not significant for any of the industry regressions. More specifically, estimates for $b_1$, $s_1$, and $h_1$ are significant in four, five, and eight industry regressions, respectively. However $f_1$ is not significant for any of the ten industry regressions, indicating that the component of B/M correlated with investor sentiment has no explanatory power for annual industry returns.

| Table 5: Annual time-series regression using SUR estimation method | | | | | | | |
|---|---|---|---|---|---|---|---|
| Industry | $f_0$ | $a_1$ | $f_1$ | $b_1$ | $s_1$ | $h_1$ | $m_1$ |
| Consumer NonDurables | 4.855*** | 0.624 | 5.151 | 0.047 | 0.627*** | -0.440*** | -0.072 |
| | -1.807 | -4.477 | -4.126 | -0.15 | -0.217 | -0.162 | -0.199 |
| Consumer Durables | 2.613 | -11.810* | 5.017 | -0.177 | 0.039 | 0.745** | 0.388 |
| | -2.676 | -6.505 | -5.095 | -0.272 | -0.366 | -0.307 | -0.283 |
| Manufacturing | -0.171 | 3.055 | 0.352 | 0.396*** | -0.499*** | -0.256** | -0.108 |
| | -0.797 | -3.159 | -2.154 | -0.103 | -0.161 | -0.122 | -0.154 |
| Oil, Gas, and Coal Extraction and Products | -2.639 | 2.218 | -0.854 | 0.199 | -0.585* | -0.441* | 0.117 |
| | -1.613 | -5.041 | -3.186 | -0.19 | -0.302 | -0.243 | -0.23 |
| Business Equipment | -3.892 | -4.952 | -2.252 | -0.343** | -0.41 | 0.874*** | -0.044 |
| | -3.019 | -5.432 | -3.635 | -0.163 | -0.265 | -0.207 | -0.261 |

| Table 5: Annual time-series regression using SUR estimation method | | | | | | | |
|---|---|---|---|---|---|---|---|
| Industry | $f_0$ | $a_1$ | $f_1$ | $b_1$ | $s_1$ | $h_1$ | $m_1$ |
| Telephone/Television Transmission | -0.184 | 0.376 | -5.389 | -0.350* | 0.201 | 0.797*** | -0.235 |
| | -1.555 | -5.945 | -4.579 | -0.179 | -0.231 | -0.222 | -0.283 |
| Wholesale, Retail, and Some Services | 5.299** | -11.215* | 4.994 | 0.014 | 0.914*** | 0.109 | 0.265 |
| | -2.587 | -6.578 | -4.789 | -0.212 | -0.326 | -0.277 | -0.266 |
| Healthcare, Medical Equipment, and Drugs | -1.708 | 11.17 | -3.504 | -0.03 | 0.712** | -0.940*** | -0.458 |
| | -6.966 | -7.347 | -6.022 | -0.241 | -0.363 | -0.288 | -0.307 |
| Utilities | -0.569 | -4.261 | 3.838 | 0.514* | 0.247 | -0.22 | 0.045 |
| | -2.061 | -7.463 | -4.471 | -0.293 | -0.321 | -0.363 | -0.476 |
| Other | -0.193 | 1.943 | -0.497 | -0.047 | 0.078 | -0.286*** | -0.226** |
| | -1.05 | -1.72 | -1.302 | -0.062 | -0.1 | -0.075 | -0.096 |

*** denotes significance at the 1% level.** denotes significance at the 5% level.* denotes significance at the 10% level.
Model is: $R_{it}-R_{ft} = a_0 + a_1 B/M_{i,t-1} + (b_0 + b_1 B/M_{i,t-1})(R_{mt}-R_{ft}) + (s_0 + s_1 B/M_{i,t-1})(SMB_t) + (h_0 + h_1 B/M_{i,t-1})(HML_t) + (m_0 + m_1 B/M_{i,t-1})(MOM_t) + (f_0 + f_1 B/M_{i,t-1})(sfraw1_t) + e_{it}$, where i is the industry, t is the year, $R_i$ is the value-weighted industry portfolio return, and $R_f$ is the risk-free interest rate as measured by the three-month Treasury bill. $R_{mt}-R_{ft}$ is the CRSP value-weighted market index excess return, SMB is the return to small stocks less the returns to large stocks, HML is the returns to high B/M stocks less the returns to low B/M stocks, MOM is the returns to high momentum stocks less the returns to low momentum stocks. Standard error is in parenthesis.

Next, we replicate table 4 using the Newey-West estimation method. The results are reported in table 6. Two investor sentiment factors have significance in explaining industry returns at about the same level and frequency as B/M, for which the estimate is significant in seven industry regressions. The estimates for Sfraw1 and sf1 are both significant in eight of the ten industry regressions. Based on these results, we will estimate model (2) with sfraw1 and sf1 as proxies of investor sentiment to compare with the Fama-French factors as components of B/M in explaining industry excess returns.

| Table 6: Annual time series regression of residual industry returns on investor sentiment and B/M: Newey-West estimation method | | | | | | |
|---|---|---|---|---|---|---|
| Industry | cef | sf2 | sf2raw | sf1 | sf1raw | bm |
| Consumer NonDurables | 0.884 | -24.204** | 31.677** | 34.446*** | -41.407** | 38.061** |
| | -0.609 | -11.594 | -12.296 | -11.806 | -18.007 | -17.886 |
| Consumer Durables | 0.145 | -7.01 | 3.817 | 29.410*** | -30.131** | 45.899*** |
| | -0.906 | -15.546 | -15.806 | -10.822 | -12.817 | -15.286 |
| Manufacturing | 0.072 | -9.568 | 8.489 | 23.574** | -30.556*** | 31.112*** |
| | -0.735 | -12.868 | -12.467 | -9.078 | -9.72 | -10.21 |

**Table 6: Annual time series regression of residual industry returns on investor sentiment and B/M: Newey-West estimation method**

| Industry | cef | sf2 | sf2raw | sf1 | sf1raw | bm |
|---|---|---|---|---|---|---|
| Oil, Gas, and Coal Extraction and Products | 0.264 | -0.2 | -0.735 | 15.001 | -20.545* | 22.807 |
| | -0.823 | -17.53 | -16.448 | -12.864 | -11.533 | -14.873 |
| Business Equipment | 0.893 | -19.152 | 13.929 | 23.218* | -20.530** | 14.717 |
| | -1 | -22.058 | -22.777 | -11.923 | -10.074 | -11.056 |
| Telephone and Television Transmission | 0.557 | -23.172 | 26.983 | 9.976 | -13.457 | 14.834 |
| | -1.081 | -18.035 | -17.871 | -11.845 | -9.671 | -10.182 |
| Wholesale, Retail, and Some Services | 0.7 | -19.192 | 24.426* | 37.898*** | -44.600*** | 45.698** |
| | -0.883 | -15.427 | -13.859 | -12.903 | -15.687 | -18.025 |
| Healthcare, Medical Equipment, and Drugs | 1.287* | -35.316** | 32.531** | 38.432*** | -30.389*** | 27.202** |
| | -0.754 | -14.283 | -13.821 | -12.632 | -9.477 | -10.356 |
| Utilities | 0.584 | -11.513 | 1.826 | 22.652** | -10.122 | 20.510*** |
| | -0.64 | -11.242 | -11.995 | -8.498 | -6.836 | -5.683 |
| Other | 0.802 | -12.185 | 19.502 | 24.074* | -33.600** | 27.707** |
| | -0.743 | -14.463 | -16.869 | -12.352 | -14.18 | -12.512 |

*** denotes significance at the 1% level.** denotes significance at the 5% level.* denotes significance at the 10% level.
Model is: $R_{it}-R_{ft} = a_i + b_i (R_{mt}-R_{ft}) + s_i (SMB_t) + h_i (HML_t) + m_i (MOM_t) + \sum f_i (SF_t) + a_1 B/M_{i,t-1} + e_{it}$, where i is the industry, t is the year, $R_i$ is the value-weighted industry portfolio return, and $R_f$ is the risk-free interest rate as measured by the three-month Treasury bill. $R_{mt}-R_{ft}$ is the CRSP value-weighted market index excess return, SMB is the return to small stocks less the returns to large stocks, HML is the returns to high B/M stocks less the returns to low B/M stocks, MOM is the returns to high momentum stocks less the returns to low momentum stocks, and SF is five investor sentiment factors (Sf1, Sf2, Sf1raw, Sf2raw, Cef) as defined in table 1. Only $f_i$ is reported. Newey-West heteroscedasticity-autocorrelation corrected standard error is in parenthesis.

Tables 7 and 8 report the results of estimating model (2) using investor sentiment factors Sf1raw and Sf1. As in table 6, the Newey-West method is used to estimate the model. Similar to the results in table 5, table 7 shows that the components of B/M correlated with the Fama-French risk factors has explanatory power for industry excess returns. In other words, the estimates of $b_1$, $s_1$, $h_1$, and $m_1$ are more consistently significant across industry regressions (four, five, five, and one industry regressions, respectively), while for only two industry regressions is the estimate of $f_1$ significant. Thus, the component of B/M correlated with investor sentiment has no significant explanatory power except for the consumer non-durables and utilities industries. Similarly, table 8 shows that the component of B/M correlated with risk factors has significant explanatory power for several industry regressions. Again, the estimates for $f_1$ show the component of B/M correlated with investor sentiment has no significant explanatory power except for one industry (Oil, Gas and Coal Extraction and Products). Overall, our results provide little evidence that the component of B/M that is related to investor sentiment explains industry stock returns. In contrast, evidence is much more consistent across industry regressions that the component of B/M related to risk factors has significant explanatory power.

**Table 7: Annual time-series regression using Newey-West estimation method.**

| Industry | $f_0$ | $a_1$ | $f_1$ | $b_1$ | $s_1$ | $h_1$ | $m_1$ |
|---|---|---|---|---|---|---|---|
| Consumer NonDurables | 5.703*** | 3.386 | 7.203* | -0.057 | 0.820*** | -0.603** | -0.142 |
| | -1.694 | -5.633 | -3.949 | -0.19 | -0.228 | -0.284 | -0.276 |
| Consumer Durables | 1.257 | -15.235 | 1.557 | 0.249 | -0.127 | 1.208*** | 0.56 |
| | -2.952 | -9.765 | -5.969 | -0.248 | -0.363 | -0.409 | -0.476 |
| Manufacturing | -0.241 | 3.547 | -0.22 | 0.442*** | -0.660*** | -0.144 | -0.156 |
| | -0.613 | -3.706 | -1.477 | -0.096 | -0.16 | -0.134 | -0.204 |
| Oil/Gas/ Coal Extraction/Products | -2.166 | 5.607 | -0.7 | 0.24 | -0.801** | -0.309 | 0.408 |
| | -1.803 | -6.309 | -4.935 | -0.29 | -0.381 | -0.352 | -0.342 |
| Business Equipment | -2.918 | -6.347 | -1.294 | -0.171 | -0.323 | 0.904*** | -0.004 |
| | -2.657 | -6.747 | -4.113 | -0.185 | -0.311 | -0.22 | -0.315 |
| Telephone/Television Transmission | -0.181 | 1.831 | -2.624 | -0.489** | 0.309 | 0.662** | -0.109 |
| | -1.265 | -9.828 | -4.819 | -0.226 | -0.336 | -0.304 | -0.417 |
| Wholesale, Retail, and Some Services | 6.092 | -9.477 | 6.709 | 0.01 | 0.768* | 0.143 | 0.132 |
| | -3.664 | -13.126 | -7.524 | -0.319 | -0.457 | -0.459 | -0.66 |
| Healthcare, Medical Equipment, and Drugs | 2.193 | 12.369 | -0.013 | -0.043 | 0.756* | -0.965 | -0.431 |
| | -7.345 | -9.059 | -6.578 | -0.23 | -0.42 | -0.627 | -0.398 |
| Utilities | -1.546 | -7.863 | 7.421* | 0.557** | 0.253 | -0.156 | 0.353 |
| | -2.531 | -7.756 | -3.928 | -0.276 | -0.368 | -0.465 | -0.458 |
| Other | -0.003 | 2.588 | -0.641 | -0.092* | 0.069 | -0.271** | -0.254** |
| | -1.268 | -1.818 | -1.888 | -0.049 | -0.094 | -0.124 | -0.113 |

*** denotes significance at the 1% level.** denotes significance at the 5% level.* denotes significance at the 10% level. Model is: $R_{it}-R_{ft} = a_0 + a_1 B/M_{i,t-1} + (b_0 + b_1 B/M_{i,t-1})(R_{mt}-R_{ft}) + (s_0 + s_1 B/M_{i,t-1})(SMB_t) + (h_0 + h_1 B/M_{i,t-1})(HML_t) + (m_0 + m_1 B/M_{i,t-1})(MOM_t) + (f_0 + f_1 B/M_{i,t-1})(\mathbf{sfraw1}_t) + e_{it}$, where i is the industry, t is the year, $R_i$ is the value-weighted industry portfolio return, and $R_f$ is the risk-free interest rate as measured by the three-month Treasury bill. $R_{mt}-R_{ft}$ is the CRSP value-weighted market index excess return, SMB is the return to small stocks less the returns to large stocks, HML is the returns to high B/M stocks less the returns to low B/M stocks, MOM is the returns to high momentum stocks less the returns to low momentum stocks. Newey-West heteroscedasticity-autocorrelation corrected standard error is in parenthesis.

**Table 8: Annual time-series regression using Newey-West estimation method.**

| Industry | $f_0$ | $a_1$ | $f_1$ | $b_1$ | $s_1$ | $h_1$ | $m_1$ |
|---|---|---|---|---|---|---|---|
| Consumer NonDurables | 4.228** | 3.907 | 5.159 | -0.093 | 0.680*** | -0.633** | -0.111 |
| | -1.748 | -5.277 | -3.086 | -0.181 | -0.21 | -0.294 | -0.276 |
| Consumer Durables | 2.505 | -15.359 | 3.468 | 0.231 | -0.085 | 1.167*** | 0.573 |
| | -2.504 | -9.387 | -4.347 | -0.26 | -0.327 | -0.374 | -0.463 |
| Manufacturing | -0.28 | 3.795 | -0.564 | 0.444*** | -0.656*** | -0.143 | -0.162 |
| | -0.911 | -4.177 | -1.812 | -0.097 | -0.167 | -0.136 | -0.215 |
| Oil, Gas, and Coal Extraction and Products | -2.988 | 5.816 | -5.462* | 0.281 | -0.846** | -0.319 | 0.451 |
| | -1.962 | -7.085 | -3.079 | -0.299 | -0.369 | -0.342 | -0.352 |
| Business Equipment | 0.613 | -5.742 | 0.93 | -0.101 | -0.236 | 0.904*** | -0.059 |
| | -3.369 | -6.972 | -3.78 | -0.236 | -0.274 | -0.216 | -0.336 |
| Telephone/Television Transmission | 1.543 | 1.555 | 2.055 | -0.451* | 0.385 | 0.627* | -0.147 |
| | -1.835 | -10.141 | -6.868 | -0.255 | -0.345 | -0.342 | -0.444 |
| Wholesale, Retail, and Some Services | 6.172* | -10.044 | 7.72 | -0.064 | 0.649 | 0.118 | 0.212 |
| | -3.553 | -11.945 | -5.896 | -0.337 | -0.394 | -0.434 | -0.649 |
| Healthcare, Medical Equipment, and Drugs | -5.655 | 18.997** | -6.507 | -0.241 | 0.727* | -1 | -0.592 |
| | -5.982 | -8.635 | -4.706 | -0.226 | -0.369 | -0.633 | -0.411 |
| Utilities | 2.767 | -0.534 | 3.176 | 0.362 | 0.34 | -0.248 | 0.037 |
| | -2.375 | -9.758 | -3.687 | -0.299 | -0.389 | -0.49 | -0.587 |
| Other | -0.122 | 2.218 | -1.63 | -0.083 | 0.078 | -0.275** | -0.227* |
| | -0.98 | -1.957 | -1.257 | -0.042 | -0.094 | -0.114 | -0.117 |

*** denotes significance at the 1% level.** denotes significance at the 5% level.* denotes significance at the 10% level. Model is: $R_{it}-R_{ft} = a_0 + a_1 B/M_{i,t-1} + (b_0 + b_1 B/M_{i,t-1})(R_{mt}-R_{ft}) + (s_0 + s_1 B/M_{i,t-1})(SMB_t) + (h_0 + h_1 B/M_{i,t-1})(HML_t) + (m_0 + m_1 B/M_{i,t-1})(MOM_t) + (f_0 + f_1 B/M_{i,t-1})(\mathbf{sf1}_t) + e_{it}$, where i is the industry, t is the year, $R_i$ is the value-weighted industry portfolio return, and $R_f$ is the risk-free interest rate as measured by the three-month Treasury bill. $R_{mt}-R_{ft}$ is the CRSP value-weighted market index excess return, SMB is the return to small stocks less the returns to large stocks, HML is the returns to high B/M stocks less the returns to low B/M stocks, MOM is the returns to high momentum stocks less the returns to low momentum stocks. Newey-West heteroscedasticity-autocorrelation corrected standard error is in parenthesis.

## CONCLUSION

Debate over the role of systematic risks vis-à-vis investor sentiment persists (Griffin & Lemmon, 2002; Vassalou & Xing, 2004). At the center of this debate is the B/M ratio, which is used as a systematic risk factor in characteristic models. This study decomposes the B/M ratio to better investigate whether B/M is a proxy for the Fama-French risk factor or for investor sentiment.

More specifically, assuming that investor sentiment is driving over- and under-reaction in the market and the Fama-French risk factors are proxies for rational economic risk factors in the market, we test whether the component of B/M that is correlated with risk factors or the component that is correlated with investor sentiment better explains stock returns. As a result, we can analyze whether B/M's explanatory power of stock returns stems from correlation with systematic risks or investor sentiment.

We apply time-series regression analysis to ten industries over 1934-2003. In contrast to prior research on investor over-/under-reaction, we find investor sentiment has only marginal explanatory power. In most of the cases, the component of B/M correlated with investor sentiment is not significant in explaining time variation of industry portfolio returns. The component of B/M correlated with systematic risks better explains the time variation of industry portfolio returns.

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# A MARKOV CHAIN MODELING APPROACH FOR PREDICTING A RETAIL MORTGAGE HEALTH INDEX

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## ABSTRACT

*This paper provides an indexing procedure for a mortgage loan health status by means of a finite Markov chain approach, which converts the loan health abstract idea into a workable number system. This method could be easily extended to other banking products as well. A regression method is used to analyze the local macroeconomic factors' effect on the health index. The management of a bank could use these procedures to adjust its loan approval policies based on current characteristics and future prediction of the portfolio.*

## INTRODUCTION

An index system for the quality or health of a portfolio enables the management of a commercial lending institute to analyze the performance of its portfolio as well as its credit policy over time. Furthermore, this system should provide dynamic description of a portfolio's payment behaviors so that the management could not only have a static snapshot of credit assets' status, but also the dynamic risk characteristics. In other words, it should give the management an analytic tool to measure the credit risk over time by analyzing and predicting the transition behavior among the different states of the loan and calculating the health index of the loan.

In this paper, we use a finite Markov chain approach to provide an indexing procedure by which one can monitor the health status of a mortgage loan over time.

## LITERATURE REVIEW

There are many quantitative methods in credit asset management. (White, 1993) surveyed some models employed in the banking industry. The models include discriminant analysis, decision tree, expert system for static decision, dynamic programming, linear programming, and Markov chains for dynamic decision models. Which model is best depends on the situation and the purpose of the analysis.

However, in the analysis of credit risk and selection of optimal policy, the standard approach is to use stochastic models based on Markov transition matrices, aided by dynamic programming. As summarized by (White, 1993), Markov decision models have been used extensively to analyze real world data in (1) Finance and Investment, (2) Insurance, and (3) Credit area.

Consumer credit analysis is used to analyze account receivable, as triggered by credit sales. A model, based on the transition probability between different states, is primarily used by a company to adjust its credit sale and collection policy. Absorbing states could be reached either by collection or bad debt, both of which lead to a decline in the portfolio size.

On the other hand, by defining a past-due period as a different transient state, and default as an absorbing state, Markov models are used to analyze the characteristics of a loan portfolio, namely the estimated duration before an individual defaults, prediction of economic portfolio balance, and health index.

Cyert, Davidson and Thompson (1962) developed a finite stationary Markov chain model to predict uncollectible amounts (receivables) in each of the past due category. This classic model is referred to as the CDT model. The states of the chain ($S_j$: $j=0,1,2,\ldots,N$) were defined as normal payment, past due, and bad-debt states. The probability $P_{ij}$ of a dollar in state $i$ at time $t$ transiting to state j at time t + 1 is given as:

$$P_{ij} = B_{ij} / \Sigma_{m=0 \text{ to } J} B_{im} \quad (1)$$

where $B_{ij}$ is the amount in state $J$ at time $t+1$ which came from state $i$ in the previous period. $S_t = S_0 Q^t$ is the vector whose $j$th component is the amount outstanding for the $j$th past due category at the beginning of the $t$th period for $t=1,2,\ldots,$. Here, $Q$ is a sub-matrix, in the transition probability matrix $P_{ij}=[I \ \ O;\ R \ \ Q]$, which includes transition probabilities among the set of transient states.

Criticizing the appropriateness of the stationary Markov chain model of (Cyert, Davidson & Thompson, 1962), (Frydman, Kallberg & Li Kao, 1968) applied a mover-stayer Model as an alternative. They defined the $j$ step transition matrix of this model as $P(0, j)=SI+(I-S)M^j$, where $M=(m_{ik})$ is a transition probability matrix for "movers" from $i$ to $k$, and $S = diag(s_1,s_2,\ldots,s_w)$ represents the probability of "stayers" in state $i$. The maximum likelihood estimator for $m_{ik}$ is given as $m_{ik}^{\sim} = (n_{ii} - Jn_i) / (n_i^* - Jn_i)$, where $n_i$ is the number of observations that stay continuously in state $i$ during the period. The authors concluded that the mover-stayer model is better for empirical analysis than the stationary Markov chain model

By taking economic factors into account, (Grinold, 1983) used a finite Markov chain model to analyze a firm's market value if the firm follows an optimal policy in state $(x,y)$ at time $t$, where $x$ is the condition of the firm, and $y$ is the condition of the overall economy. He assumed that the changes in state are governed by a stationary transition function. For instance, if the state is $y(t-1)$ at time $t-1$, then it will be $y(t)$ at time $t$ with probability $\pi[y(t)y(t-1)]$.

Numerous efforts have been undertaken to analyze the relationship between credit asset quality and the macroeconomic situation. (Lee, 1997) built an ARMA model:

$$\Psi_y(L)y_{t+1}=\Theta y(L)e_{t+1,y}, \quad \Psi_m(L)m_{t+1}=\Theta_m(L)e_{T+1,m} \qquad (2)$$

under the assumption that $y_t$ and $m_t$ have univariate stationary, invertible finite-order ARMA representation, where $\Psi_y(L)$, $\Theta y(L)$, $\Psi_m(L)$, and $\Theta_m(L)$ are lag operators. The model was used to analyze the linkage between time-varying risk premia in the term structure and macroeconomic state variables. He concluded that uncertainties, related to output and the money supply, are important source of time-varying risk premia in the nominal term structure of interest rate.

Esbitt (1986) provided empirical evidence that a bank's portfolio quality has close relationship with the macroeconomic situation. Examples include the state-chartered banks' failure and Great Depression in Chicago between 1930 and 1932.

A promising model to link macroeconomic variables to a microeconomic variable is to use the State Space representation, which is based on the idea that the future of a system is independent of its past (Wei, 1990). The estimation of a state space model's parameters is difficult. (Cooper & Wood, 1981) used Maximum Likelihood to estimate the parameters. Outliers in the series could make the problem even more complicated. As pointed out by Balke and (Fomby, 1994), there are 3 possible outlier patterns: (1) Outliers associated with business cycles, (2) outliers clustered together, both over time and across series, and (3) a dichotomy between outlier behaviors of real versus nominal series. The ETS package in SAS® provides a method to check and remove outliers and to estimate the parameters of the state space model (SAS Doc, 2005).

(McNulty, Aigbe, & Verbrugge, 2001) proposed an empirical regression to study the hypothesis that small community banks have an information advantage in evaluating and monitoring loan quality. Although their study didn't concentrate on the establishment of the measure for loan quality, it rejected the hypothesis based on a sample of all Florida banks for the period 1986 to 1996.

Criticizing the limitation of the current regulation for banking industry to encourage the financial innovation, (Hauswald & Marquez, 2004) studied the relationship between the current regulative policy and the loan quality, or risks encountered by financial institute.

Using delinquencies and non-performing loans as proxies for loan quality, (Gambera, 2000) used a linear model and a vector-autoregressive (VaR) model to predict the loan quality in business cycles. Seldom have efforts been made to establish a feasible index system that enables the management to perform cross-sectional or cross-institute comparisons.

## THE MODEL

A bank's portfolio pool, say 20 years of mortgage loans, is composed of distinct individuals, who behave independently. Some of the individual loans, having been prepaid, past due, or charged off at the beginning of the measuring period, will transfer to a different state or stay in their respective states. Once a loan is charged off, the balance is removed and it could never go back to the bank's books. This Markov chain model can measure the expected duration of stay in each state and the probability of the process going back to the normal payment state. Table 1 presents the different states of the Markov chain.

| **Table 1: Definitions of the different states of the Markov chain** | | | |
|---|---|---|---|
| Transient States: | | Absorbing States: | |
| Past Due and Prepayment States $S_i$:$i$=-3,-2,-1,0,1,2,3 | | Default States $R_k$ $R_k$:$k$=1,2,3,4 | |
| $S_{-3}$ | Prepaid more than 90 days | $R_1$ | Sold by Bank |
| $S_{-2}$ | Prepaid 61 days – 90 days | $R_2$ | Foreclosure |
| $S_{-1}$ | Prepaid 31 days – 60 days | $R_3$ | Refuse to pay |
| $S_0$ | No more than 30 days past due | $R_4$ | All others reasons |
| $S_1$ | 31 days – 60 days past due | | |
| $S_2$ | 61 days – 90 days past due | | |
| $S_3$ | More than 90 days past due | | |

Transient states, $S_i$:$i$=-3,-2,-1,0,1,2,3, are defined as follows: $S_{-3}$, $S_{-2}$, $S_{-1}$ are prepayment states, while $S_1$,$S_2$,$S_3$ are past due states and $S_0$ refers to the normal payment. Without loss of generality, we assume that state $S_0$ is the most healthy state of a loan within a given time period. From the bank's point of view, although prepayment is not as adverse as past due, it is still undesirable. Behaviors of prepayment, in spite of the fact that they can insure early payback of the principle, reduce the total interests the bank could possibly earn on the outstanding loan balance at the beginning of the period. The different prepayment states are determined by the formula:

$$i = \begin{cases} -3, \text{ if } (X_t-Y_t)/Y_t \geq 3 \\ -2, \text{ if } 2 \leq (X_t-Y_t)/Y_t < 3 \\ -1, \text{ if } 1 \leq (X_t-Y_t)/Y_t < 2 \\ 0, \text{ if } 0 \leq (X_t-Y_t)/Y_t < 1 \end{cases}$$

Where $X_t$ is the actual payment at month $t$ , and $Y_t$ is the expected payment at month $t$. We follow the regular definition of past due in most commercial bank given in the Table 1. On the other hand, once a loan has been charged off, it would be eliminated from the bank's portfolio pool and transferred to a third collection company. As a result, the charge-off states are defined as $R_k$:$k$=1,2,3,4. Here, $k$ refers to different causes of charge-off.

## LOAN HEALTH INDEX

Let $H$ be the index of a portfolio, which at time $t$ has $S_i$:$i$=-3,-2,-1,0,1,2,3 transient states and $R_k$:$k$=1,2,3,4 charged-off or absorbing states. Here, H, over a given time interval 0, t, is given as

$$H=e_{-3}\Theta_{-3,0}+ e_{-2}\Theta_{-2,0} +e_{-1}\Theta_{-1,0} +e_0\Theta_{0,0} +e_1\Theta_{1,0} +e_2\Theta_{2,0} +e_3\Theta_{3,0} \qquad (3)$$

Where, $e_j$ refers to the expected duration of stay in state $j$:$j$=-3,-2,-1,0,1,2,3, $\Theta_{j,0}$ is an intensity function $j$=-3,-2,-1,0,1,2,3, measuring the transitions to the normal or health state, $S_0$. The expected duration of stay in a specific state is based on the Markov transition intensity matrix in Figure 1.

**Figure 1: Transition intensities between transient states in V, and from transient to absorbing states, U.**

**Figure 1**

$$V = \begin{array}{c} \\ S_{-3} \\ S_{-2} \\ S_{-1} \\ S_0 \\ S_1 \\ S_2 \\ S_3 \end{array} \begin{array}{c} \begin{array}{ccccccc} S_{-3} & S_{-2} & S_{-1} & S_0 & S_1 & S_2 & S_3 \end{array} \\ \begin{bmatrix} v_{-3,-3} & v_{-3,-2} & v_{-3,-1} & v_{-3,0} & v_{-3,1} & 0 & 0 \\ v_{-2,-3} & v_{-2,-2} & v_{-2,-1} & v_{-2,0} & v_{-2,1} & 0 & 0 \\ v_{-1,-3} & v_{-1,-2} & v_{-1,-1} & v_{-1,0} & v_{-1,1} & 0 & 0 \\ v_{0,-3} & v_{0,-2} & v_{0,-1} & v_{0,0} & v_{0,1} & 0 & 0 \\ v_{1,-3} & v_{1,-2} & v_{1,-1} & v_{1,0} & v_{1,1} & v_{1,2} & 0 \\ v_{2,-3} & v_{2,-2} & v_{2,-1} & v_{2,0} & v_{2,1} & v_{2,2} & v_{2,3} \\ v_{3,-3} & v_{3,-2} & v_{3,-1} & v_{3,0} & v_{3,1} & v_{3,2} & v_{3,3} \end{bmatrix} \end{array} \qquad U = \begin{array}{c} \\ S_{-3} \\ S_{-2} \\ S_{-1} \\ S_0 \\ S_1 \\ S_2 \\ S_3 \end{array} \begin{array}{c} \begin{array}{cccc} R_1 & R_2 & R_3 & R_4 \end{array} \\ \begin{bmatrix} \mu_{-3,1} & \mu_{-3,2} & \mu_{-3,3} & \mu_{-3,4} \\ \mu_{-2,1} & \mu_{-2,2} & \mu_{-2,3} & \mu_{-2,4} \\ \mu_{-1,1} & \mu_{-1,2} & \mu_{-1,3} & \mu_{-1,4} \\ \mu_{0,1} & \mu_{0,2} & \mu_{0,3} & \mu_{0,4} \\ \mu_{1,1} & \mu_{1,2} & \mu_{1,3} & \mu_{1,4} \\ \mu_{2,1} & \mu_{2,2} & \mu_{2,3} & \mu_{2,4} \\ \mu_{3,1} & \mu_{3,2} & \mu_{3,3} & \mu_{3,4} \end{bmatrix} \end{array}$$

The transitions intensities are defined as (Chiang, 1980):

$v_{ij}\Delta t$= Pr {an individual in state $S_i$ at time $\tau$ will be state $S_j$ at time $\tau+\Delta t$},
where $i \neq j$:$i,j$=-3,-2,-1,0,1,2,3 are the transient states.
$\mu_{ik}\Delta t$= Pr {an individual in state $S_i$ at time $\tau$ will be state $R_k$ at time $\tau+\Delta t$},
where, $i$=-3,-2,-1,0,1,2,3 and $k$=1,2,3,4, $k$ being the absorbing states.

Furthermore, we assume that the intensities $v_{ij}$ and $\mu_{ik}$ are independent of time $\tau(0 \leq \leq t)$. Thus, we are concerned here with a time homogenous Markov chain.

If an individual stays in its original state, its intensity is defined by $v_{ii}=-[_{j=-3\ to 3}v_{ij}+\Sigma_{k=1\ to\ 4}u_{jk}]$ ,$i \neq j$. By this definition, it is obvious that $1+v_{ii}t$= Pr {an individual in state $S_i$ at time $\tau$ will remain in state $S_i$ at time $\tau+\Delta t$}. Within any single time interval, {$\tau+\Delta t$ }, $V$ is the prepayment and past due intensity matrix.

Let $P_{ij}(\tau,t)$ be the probability that an individual in state $S_i$ at time $\tau$ will be in state $S_j$ at time $\tau$, $i,j$=-3,-2,-1,0,1,2,3 and $e_{ij}$ be its expected duration of stay in state $j$. It can be shown (Chiang, 1980) that:

$$P_{ij}(0,t)=\Sigma_{l=-3\ to\ 3[}e^\wedge(\rho_l t)]*[A'_{ij}(\rho_l)]/[\Pi_{m=-3\ to\ 3, m\neq l}(_l\text{-}\rho_m)] \quad (4)$$

and

$$e_j=\Sigma_{i=-3\ to\ 3}e_{ij}$$
$$=\Sigma_{i=-3\ to\ 3}\{\Sigma_{l=-3\ to\ 3[}e^\wedge(\rho_l t)-1]*\pi_i*[A'_{ij}(\rho_l)]/[\Pi_{m=-3\ to\ 3, m\neq l}(_l\text{-}\rho_m)\ \rho_l]\} \quad (5)$$

where, $\pi_i$,$i=-3,-2,-1,0,1,2,3$, is the proportion of individuals in the portfolio pool who are initially in $S_i$, $i=-3,-2,-1,0,1,2,3$ and $e_j$ is the expected duration of stay in state $j$ irrespective of the initial starting state.

Here, $A'_{ij}(\rho_l)$ is the $ij$ co-factor of $A'(\rho_l)$, defined as:

$$A'(\rho_l)=(\rho_l\text{-}V') \quad (6)$$

where $\rho_l$- = the lth eigenvalue of the characteristic matrix, ($\rho_l$-$V'$).

In the health index of Eq. (3), it can be seen that $\Theta_{j,o}$ measures an individual's ability to recover from the semi-health prepayment and past due state $Sj,j=-3,-2,-1,0,1,2,3$ to a pure health state, $S_0$. For a given time period, the Maximum Likelihood estimate (Chiang, 1980) of $\Theta_{i,0}$ is given as:

$$\Theta^\wedge_{j,0}=(\Sigma_{r=1\ to\ N}\ n_{i,0,r})/(\Sigma_{r=1\ to\ N}t_{j,r}),j=-3,-2,-1,0,1,2,3 \quad (7)$$

Where, $n_{i,0,r}$ is the number of transitions from $S_i$:$i=-3,-2,-1,0,1,2,3$ to $S_0$ by the $r$th individual. As such, $\Sigma_{r=1\ to\ N}\ n_{i,0,r}$ is the total number of transitions made by all $N$ individuals in the portfolio. By the same reasoning, $\Sigma_{r=1\ to\ N}t_{j,r}$ is the total length of time that all individuals in the portfolio stay in $S_i$:$i=-3,-2,-1,0,1,2,3$. Therefore, from Eqs. (3) ,(5) and (7), the portfolio health index is given as:

$$H=\Sigma_{j=-3\ to\ 3}\Sigma_{i=-3\ to\ 3}\Sigma_{l=-3\ to\ 3}\{\pi_i*A'_{ij}(\rho_l)[e^\wedge(\rho_l t)-1](\Sigma_{r=1\ to\ N}n_{i,0,r})/\Pi_{m=-3\ to\ 3, m\neq l}(_l\text{-}\rho_m)\rho_l(\Sigma_{r=1\ to\ N}t_{j,r})\} \quad (8)$$

Let $c_i$ be the number of loans in state $i$ at the initial starting date. Thus, $\pi_i$ can be estimated as:

$$\pi_i=c_i/(\Sigma_{i=-3\ to\ 3}\ c_i),\ i=-3,-2,-1,0,1,2,3 \quad (9)$$

## APPLICATION

Data over 16 one-month periods of retail mortgage loans, provided by an Ohio local bank, was used to estimate the health index of the loans and to analyze the relationship between the macroeconomic factors and the retail mortgages health index of this bank.

**Health Index Model**

A practical method for estimating $\Theta_{j,0}$ in Equation (3) from the data over a given time period 0, t is:

$$\hat{\Theta}^{t}_{j,0}=p_{j,o}N_t/30N_t\delta_j, j=-3,-2,-1,0,1,2,3, t=1,2,\ldots,16 \quad (10)$$

Where $\hat{\Theta}^{t}_{j,0}$ is the intensity function for period $t$, $N_t$ is the total number of retail mortgages for period $t$, $N_t=(\Sigma_{s=-3 \text{ to } 3}N_{s,t})$. Thus, $N_t$ represents all individuals in the transient states. Also, $p_{j,o}N_t$ is the expected number of transitions from state $S_j$ to state $S_0$ made by all individual loans during period t, where, $p_{j,o}$ is the transition probability from $S_j$ to $S_0$.

In equation (10), $\delta_j$ is defined as

$$\delta_j=\begin{cases} 1, \text{ if an individual is in state } S_j \\ 0, \text{ otherwise} \end{cases}$$

We use $30N_t\delta_j$ to approximate the total length of time that all individuals in the portfolio stay in $S_j$, $j=-3,-2,-1,0,1,2,3$. As a result, $30N_t\delta_j$ gives the length of time for all individuals staying in state $S_j$ during the one month period between check points. Table 2 gives $N_t$, the total number of retail mortgages in the transient states at time t.

**Table 2: $N_t$, the total number of retail mortgages in the transient states at time t.**

| time t | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| $N_t$ | 917 | 875 | 836 | 821 | 805 | 786 | 742 | 741 |
| time t | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| $N_t$ | 680 | 668 | 641 | 634 | 598 | 563 | 521 | 517 |

Also, the transition probabilities and expected duration for $t=1$, calculated by equations (4) and (5), respectively, are given in Figure 2.

As an example, the intensity function, $\Theta_{-3,0}$, in equation (10) for the health index at time t=1, is estimated as

$$\hat{\Theta}^{1}_{-3,0}=(p_{-3,0}N_1)/(30N_t\delta_j)=(0.11175*917)/(30*20)=0.170 \quad (11)$$

**Figure 2: Transition probability matrix, $p_{ij}(0,1)$, and expected duration of stay matrix, $e_{ij}(1)$.**

$$p_{ij}(0,1) = \begin{array}{c} \\ S_{-3} \\ S_{-2} \\ S_{-1} \\ S_0 \\ S_1 \\ S_2 \\ S_3 \end{array} \begin{array}{ccccccc} S_{-3} & S_{-2} & S_{-1} & S_0 & S_1 & S_2 & S_3 \\ \hline 0.0824 & 0.1067 & 0.0878 & 0.1117 & 0.0843 & 0 & 0 \\ 0.0858 & 0.1110 & 0.9146 & 0.1163 & 0.0877 & 0 & 0 \\ 0.0900 & 0.1164 & 0.0958 & 0.1218 & 0.0918 & 0 & 0 \\ 0.0874 & 0.1131 & 0.0932 & 0.1185 & 0.0894 & 0 & 0 \\ 0.0621 & 0.0806 & 0.0667 & 0.0849 & 0.0646 & 0.0607 & 0 \\ 0.0504 & 0.0654 & 0.0543 & 0.0693 & 0.0530 & 0.0502 & 0.0334 \\ 0.0416 & 0.0540 & 0.0449 & 0.0573 & 0.044 & 0.0416 & 0.0278 \end{array}$$

$$e_{ij}(1) = \begin{array}{c} \\ S_{-3} \\ S_{-2} \\ S_{-1} \\ S_0 \\ S_1 \\ S_2 \\ S_3 \end{array} \begin{array}{ccccccc} S_{-3} & S_{-2} & S_{-1} & S_0 & S_1 & S_2 & S_3 \\ \hline 0.6595 & 0.8416 & 0.7224 & 0.8897 & 0.7071 & 0 & 0 \\ 0.6876 & 0.8775 & 0.7534 & 0.9279 & 0.7375 & 0 & 0 \\ 0.7212 & 0.9202 & 0.7898 & 0.9727 & 0.7728 & 0 & 0 \\ 0.7006 & 0.8940 & 0.7674 & 0.9452 & 0.7511 & 0 & 0 \\ 0.4942 & 0.6311 & 0.5426 & 0.6686 & 0.5328 & 0.4897 & 0 \\ 0.4062 & 0.5189 & 0.4465 & 0.5504 & 0.4394 & 0.4046 & 0.2690 \\ 0.3362 & 0.4294 & 0.3697 & 0.4558 & 0.3641 & 0.3354 & 0.2231 \end{array}$$

Table 3 presents estimates of the intensity functions, $\hat{\Theta}^{1}_{si,0}$ (i= -3, -2, -1, 0, 1, 2, 3) and expected duration of stay in a transient state, $e_i$, for $t=1$, based on the calculation using Excel.

**Table 3: Estimates of the intensity functions, $\hat{\Theta}^{1si,0}$, and expected duration in a transient state, $e_i$, for $t=1$.**

| State | $S_{-3}$ | $S_{-2}$ | $S_{-1}$ | $S_0$ | $S_1$ | $S_2$ | $S_3$ |
|---|---|---|---|---|---|---|---|
| $p_{j,0}$ | 0.11175 | 0.1163 | 0.1218 | 0.1185 | 0.0849 | 0.0693 | 0.0573 |
| $N_1\delta_j$ | 20 | 19 | 75 | 778 | 19 | 2 | 4 |
| $\hat{\Theta}^{1\text{-}3,0}$ | 0.1708 | 0.1871 | 0.0496 | 0.0047 | 0.1366 | 1.0591 | 0.4379 |
| $e_i$ | 0.8897 | 0.9279 | 0.9727 | 0.9452 | 0.6686 | 0.5504 | 0.4558 |

Here, $e_i$ and $p_{j,0}$ are the elements of the transition probability and expected duration of stay matrices, given in Figure 2, at row $S_{-i}$ and column $S_0$ .

From the data in Table 3, the health index in Equation (3) is estimated to be 1.1001. By the same method, we calculated the health indexes from period 1 to period 16 which are given in Table 4.

| Table 4: Health indices from period 1 to period 16. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| time *t* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| $H_t$ | 1.1001 | 1.1178 | 1.4247 | 1.3302 | 1.329 | 1.2974 | 1.2145 | 1.1952 |
| time *t* | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| $H_t$ | 1.0347 | 1.1244 | 1.13 | 1.1427 | 1.1524 | 1.1198 | 1.1024 | 1.0872 |

## Regression Model

The macroeconomic environment is long believed to play a central role in the analysis of loan payment behaviors and the health index. The health index will more useful if it is linked to some macro-factors which will enable bank management to predict the portfolio quality.

Several studies have considered the use of macro-factors to predict future health status of different industries. (Liu, Hassan & Nassar, 2007) used the state space time series model along with macro factors such as GDP, interest rate, unemployment, inflation, and disposable personal income to analyze the sensitivities of industrial production indices (including banking) to the above macro-factors. (Ludvigson & Ng, 2007, 2008) used regression and Principle Component methodology, to analyze the relationship between bond risk and macro-factors. Studies along this line also include (Bai & Ng, 2008), (Forni, Hallin, Lippi & Reichlin, 2005), and (Boivin & Ng, (2005).

To predict the future health index under different economic conditions, a multivariate regression model was proposed to analyze the sensitivity of the health index to local macroeconomic factors. Following previous studies with suggested macro-factors, the model is given as:

$$H=b_0+b_1Ir+b_2Un+b_3In+b_4Dpi \qquad (12)$$

*W*here, *H,* the health index, is the dependent variable. The four independent variables include *Ir*, interest rate, *Un* ,unemployment, *In* , inflation, and *Dpi*, disposable personal income.

The local macroeconomic data extracted by econmagic.com, the commercial economic database is given in Table 5.

Thus, using the stepwise regression procedure in SAS on the full model in Eq. (12), we obtained the reduced model in Eq. (13), showing that the retail mortgage loan health index was only related to DPI. The stepwise procedure is especially useful when there is multicollinearity in the data. In this case, the variance inflation factor (VIF) was larger than 5 for IR and DPI, an indication of multicollinearity (Montgomery, Peck & Vining 2001). Repeating the analysis with IR deleted from the data gave the same model in Eq. (13) using the stepwise procedure.

| Table 5: Local macroeconomic variables. | | | | | |
|---|---|---|---|---|---|
| Period | Year Mon | Unemployment | Interest rate | Inflation | DPI |
| 1 | 2005 05 | 5.6 | 5.72 | 4.62 | 4.78 |
| 2 | 2005 06 | 6.1 | 5.58 | 5.62 | 4.63 |
| 3 | 2005 07 | 5.8 | 5.7 | 7.69 | 4.48 |
| 4 | 2005 08 | 5.5 | 5.82 | 6.98 | 4.3 |
| 5 | 2005 09 | 5.6 | 5.77 | 5.71 | 4.2 |
| 6 | 2005 10 | 5.3 | 6.07 | 3.06 | 3.9 |
| 7 | 2005 11 | 5.6 | 6.33 | 7.56 | 3.8 |
| 8 | 2005 12 | 5.5 | 6.27 | 6.05 | 4.3 |
| 9 | 2006 01 | 6.1 | 6.15 | 8.18 | 3.3 |
| 10 | 2006 02 | 6.1 | 6.25 | 0.61 | 3.5 |
| 11 | 2006 03 | 5.3 | 6.32 | 4.3 | 3.2 |
| 12 | 2006 04 | 5.4 | 6.51 | 7.45 | 2.7 |
| 13 | 2006 05 | 4.9 | 6.6 | 5.51 | 2.5 |
| 14 | 2006 06 | 5.2 | 6.68 | 2.4 | 2.5 |
| 15 | 2006 07 | 5.8 | 6.76 | 5.47 | 2.5 |
| 16 | 2006 08 | 5.4 | 6.52 | 2.99 | 2.1 |

Table 6 gives the statistical analysis for the regression model:

$$H=0.9585+0.0629DPI \tag{13}$$

An indicator of model significance as a whole is the P-value of the F test, which is 0.0441. Because the critical value is $\alpha=0.05$ and the P-value for the F test is smaller than 0.05, the model is significant as a whole. Also, $R^2=25.9\%$ means that 25.9% of the total variation of the dependent variable, which is the loan health index, could be explained by the model. The positive sign for the parameter *DPI*, or disposable personal income, indicates that as the DPI increases, the loan health index improves. This is in accord with what one expects, namely that customers with higher *DPI* would have more buffer against adverse events and thus their mortgage would be served better under this circumstance. The model could be made more accurate with more data available. For instance, in the regression analysis, unemployment was marginally significant with a regression coefficient of *-0.12308* ($p = 0.1284$). If kept with *DPI in* Eq. (13), R-square would have increased to 0.3839.

An important reason for the relatively low R-square in the regression model is perhaps the presence of important variables that were not included in the model. Future study will focus on developing an empirical model for mortgage risk assessment by investigating additional variables such as property value relative to market value, housing price index, age of the mortgage loan, interest rate, total family income, number of borrowers on the mortgage, primary or secondary residence, loan market value/housing price index, credit score, the amount of time credit has been established, length of time at present residence, and age of borrower.

**Table 6: Analysis of Variance for Regression From the Stepwise Procedure**

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 1 | 0.04588 | 0.04588 | 4.89 | 0.0441 |
| Error | 14 | 0.13129 | 0.00938 | | |
| Corrected Total | 15 | 0.17718 | | | |
| R-Square | 0.259 | | | | |
| Parameter Estimates | | | | | |
| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
| Intercept | 1 | 0.95853 | 0.10363 | 9.25 | <.0001 |
| x4 | 1 | 0.0629 | 0.02844 | 2.21 | 0.0441 |

## CONCLUSION

The model in this paper provides a stochastic measurement for the loan payment behavior and a measure of the health index of the loan. The loan health index could be related to local microeconomic factors for predicting its behavior. Regression results revealed that of four factors (unemployment, interest rate, inflation, and disposable personal income) only disposable personal income had an effect (positive) on the health index of the loan. Unemployment showed a negative effect on the health index, but this was only significant at the 0.1284 level. The model may be improved as more data and variables become available.

This modeling approach to measure and predict the behavior of the health index of a mortgage loan is useful for the management of a bank in their loan approval policy.

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# THE IMPACT OF SPLIT BOND RATINGS ON ACCOUNTING RESEARCH RESULTS: SOME ADDITIONAL EVIDENCE AND SOME PRELIMINARY INSIGHTS

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## ABSTRACT

*A split bond rating occurs when at least two bond rating agencies (e.g., Moody's and S&P) disagree on the rating of a particular bond issue. Prior accounting studies that employ bond ratings (as either independent or dependent variable measures) do not use more than one source of bond ratings (e.g., Khurana and Raman, 2003; and, Brandon et al., 2004) and thus do not minimize potential bond rating agency bias—at least with respect to the split rated bonds included in such accounting studies. Admittedly, while the extent, if any, of the potential bias associated with using only one data source has yet to be quantified, it appears that some bias exists given that a majority of the research to date suggests that Moody's bond ratings are more conservative than S&P bond ratings. Consistent with the majority of the previous bond rating research results, the empirical results of our study also support the conclusion that Moody's bond ratings are generally more conservative than S&P bond ratings. This finding leads us to suggest that accounting researchers should employ multiple bond rating sources when conducting research on bond ratings to minimize the potential for bond rating agency bias.*

## INTRODUCTION

Dandapani and Lawrence (2007) indicate that an investor uses bond ratings to measure the relative credit risk of bonds. Additionally, they state that bond ratings affect a firm's access to capital as well as its cost of capital. Further, they suggest that two major credit rating agencies dominate the market in rating publicly traded bonds—Moody's Investors Service (Moody's) and Standard & Poor's (S&P). When Moody's and S&P (or some other credit rating agencies) disagree on the rating of a particular bond issue, a "split rating" is said to have occurred.

Livingston et al. (2007) indicate that about 20% of U.S. corporate and municipal bonds have letter split ratings (e.g., Ba versus B; and, BB versus B) while approximately 50% of notch-level ratings are split (e.g., B2 versus B3; and, B versus B-). Unfortunately, accounting studies that employ bond ratings (as either independent or dependent variable measures) do not address the issue of split bond ratings because such studies do not use more than one bond rating source (e.g., Khurana and Raman, 2003; and, Brandon et al., 2004). Thus the results of such accounting studies may be influenced by bond rating agency bias. Stated otherwise, we believe that the use of only one bond rating source may bias (to some unknown degree) the results of accounting studies employing bond ratings since such accounting studies most likely include split rated bond issues. Accordingly, to gain insights regarding the potential influence of split ratings on the results of previous accounting studies and to provide guidance with respect to future accounting studies employing bond ratings, we use the following strategy. First, we identify and summarize recent accounting studies that employ bond ratings. Second, we review the split bond rating literature. Third, we provide additional evidence to support the majority view that Moody's bond ratings are more conservative than S&P bond ratings. Finally, we discuss the potential limitations of not using multiple bond rating sources when conducting accounting studies employing bond ratings.

## RECENT ACCOUNTING STUDIES

We noted two recent studies that we believe represent the current methodological state of accounting research employing bond ratings—Khurana and Raman (2003) and Brandon et al. (2004). Key methodological characteristics of these two studies are summarized in Table 1. Khurana and Raman (2003) use S&P bond ratings (n = 667) as one of their independent variables and "yield to maturity" as their dependent variable in a regression analysis. In contrast, Brandon et al. (2004) use Moody's bond ratings (n = 333) as their dependent variable; they employ logistic regression since bond rating data are polychotomous. Both studies employ Compustat accounting data as their data source.

**Table 1: Summary of Recent Accounting Studies Employing Bond Ratings**

| Item | Khurana and Raman (2003) | Brandon et al. (2004) |
|---|---|---|
| Subject Area | Financial Accounting | Auditing |
| Bond Rating Source | S&P Ratings | Moody's Ratings |
| Dependent Variable | Yield to Maturity | Bond Ratings |
| Data Source for Independent Variables | Compustat | Compustat |
| Sample Size | 667 | 333 |
| Statistical Procedure | Regression | Logistic Regression |

Khurana and Raman (2003) find "…the fundamentals [detailed financial accounting information] to be priced in the market for new bond issues as indicators of expected future earnings and to be value-relevant in enabling the market to discern differences in bond credit quality over and above the published bond ratings." In turn, the results of Brandon et al. (2004) "indicate that the amount of nonaudit services provided by a firm's external auditors is negatively associated with that client's bond rating." While we believe that both of these studies contribute to the accounting literature, we also believe that the use of only one bond rating source represents a limitation in both studies because the use of only one bond rating source masks the potential influence, if any, of split ratings on the results of these studies. The remainder of our study documents the logic underpinning our concern.

## PREVIOUS RESEARCH ADDRESSING SPLIT RATINGS

Billingsley et al. (1985) and Liu and Moore (1987) assert that when split ratings exist, investors primarily focus their attention on the lower of the two ratings. In contrast, Hsueh and Kidwell (1988) and Reiter and Ziebart (1991) find that investors primarily focus on the higher of the two ratings when determining the market price of a bond. While Cantor and Packer (1997b) find that the price of a split-rated bond reflects the average of the two ratings, the results of Jewell and Livingston (1998) on this issue are inconclusive. Livingston et al (2007, p. 61) suggest that "…split-rated bonds should be priced to offer additional risk premiums to compensate investors for the uncertainty about the issuing firm's fundamentals."

To varying degrees, uncertainty about the issuing firm's fundamentals relates to asset opaqueness (i.e., the inability to determine the value of an asset). On this issue, Morgan (2002) states that split ratings are the result of the asset opaqueness of some firms—especially banks. Somewhat similarly, Livingston et al. (2007) attribute split ratings to the level of asset opaqueness (informational asymmetry) of a firm.

Moon and Stotsky (1993) and Cantor and Packer (1997a) suggest that split ratings result from differences in rating scales (e.g., standards, cut off points and/or weights associated with rating determinants). However, Dandapani and Lawrence (2007) find that differences in rating scales are not the only explanation for split ratings. They (p. 79) indicate that their results "…suggest that about one-third of the bond split ratings can be due to the differences in ratings scales, while the remaining two-thirds are due to other reasons such as information asymmetry, judgmental differences, and randomness."

While Ederington (1986) asserts that split ratings are caused by random errors associated with a particular credit rating agency, Livingston et al. (2007) provide evidence that split ratings are not always associated with such random errors. Specifically, they (p. 50) find that "…split ratings are not symmetric between the two rating agencies. Instead, split ratings are more lopsided, with Moody's consistently on the downside." Stated otherwise, Livingston et al. (2007) find that Moody's bond ratings are generally more conservative (lower) that S&P bond ratings.

While the results of Livingston et al. (2007) are consistent with the results of Horrigan (1966), Morton (1975), and Perry (1985), the results are inconsistent with Cates (1977) who finds that S&P bond ratings are more conservative than Moody's bond ratings. This inconsistency may be associated with Cates' (1977) focus on bank holding companies (see Morgan, 2002). Before commenting on the possible influence of split bond ratings on accounting research results, we provide additional evidence to support the "majority view" that Moody's bond ratings are generally more conservative than S&P bond ratings.

## DATA COLLECTION

There are 333 new bonds included in our study. These new bonds were issued from January 2004 through June 2006 and were rated by both Moody's and S&P. We collected Moody's bond ratings from the Long Term Debt Section of Mergent Online (www.mergentonline.com) and S&P bond ratings from the Credit Ratings Search Section of the S&P website (www.standardandpoors.com). As indicated in Table 2, the Moody's bond ratings range from Caa3 (greatest credit risk) to Aaa (least credit risk). All Moody's bond ratings except for Aaa are modified by the addition of a 1, 2, or 3 to show relative standing within the category, where the highest within the rating is 1 and the lowest is 3. The equivalent symbols used by S&P to designate its bond ratings are also provided in Table 2.

**Table 2: Initial Bond Rating Distribution**

| Moody's Ratings | Number of Issues | S&P Ratings | Number of Issues |
|---|---|---|---|
| Aaa | 3 | AAA | 3 |
| Aa1 | 0 | AA+ | 0 |
| Aa2 | 4 | AA | 9 |
| Aa3 | 10 | AA- | 8 |
| A1 | 13 | A+ | 13 |
| A2 | 18 | A | 21 |
| A3 | 15 | A- | 21 |
| Baa1 | 20 | BBB+ | 21 |
| Baa2 | 35 | BBB | 30 |
| Baa3 | 28 | BBB- | 26 |
| Ba1 | 15 | BB+ | 18 |
| Ba2 | 27 | BB | 18 |
| Ba3 | 28 | BB- | 23 |

| Table 2: Initial Bond Rating Distribution | | | |
|---|---|---|---|
| Moody's Ratings | Number of Issues | S&P Ratings | Number of Issues |
| B1 | 32 | B+ | 34 |
| B2 | 29 | B | 44 |
| B3 | 39 | B- | 25 |
| Caa1 | 14 | CCC+ | 13 |
| Caa2 | 2 | CCC | 6 |
| Caa3 | 1 | CCC- | 0 |
| Total | 333 | Total | 333 |

Hollander and Wolfe (1999) suggest that the expected frequency of observations in each category should be at least five observations when performing statistical analyses. Since there are fewer than five observations for the Moody's bond ratings designated Aaa, Aa1, and Aa2, we group the observations in these categories into a single category that we identify as "Aa2 and above" as shown in Table 3. We group Caa1, Caa2 and Caa3 for similar reasons and identify the resulting group as "Caa1 and below." Similar aggregation is done for categories with less than five observations with respect to the S&P bond ratings; that is, AAA, AA+ and AA are grouped and identified as "AA and above" and CCC+, CCC and CCC- are grouped into a category represented as "CCC+ and below." As a result of this aggregation, fifteen bond rating categories remain for both Moody's and S&P as shown in Table 3.

| Table 3: Bond Rating Distribution—Fifteen Categories | | | |
|---|---|---|---|
| Moody's Ratings | Number of Issues | S&P Ratings | Number of Issues |
| Aa2 and Above | 7 | AA and Above | 12 |
| Aa3 | 10 | AA- | 8 |
| A1 | 13 | A+ | 13 |
| A2 | 18 | A | 21 |
| A3 | 15 | A- | 21 |
| Baa1 | 20 | BBB+ | 21 |
| Baa2 | 35 | BBB | 30 |
| Baa3 | 28 | BBB- | 26 |
| Ba1 | 15 | BB+ | 18 |
| Ba2 | 27 | BB | 18 |
| Ba3 | 28 | BB- | 23 |
| B1 | 32 | B+ | 34 |

| Table 3: Bond Rating Distribution—Fifteen Categories | | | |
|---|---|---|---|
| Moody's Ratings | Number of Issues | S&P Ratings | Number of Issues |
| B2 | 29 | B | 44 |
| B3 | 39 | B- | 25 |
| Caa1 and Below | 17 | CCC+ and Below | 19 |
| Total | 333 | Total | 333 |

## DATA ANALYSIS

Of the 333 bonds included in our study, 172 (52%) were assigned the same rating (i.e., the same equivalent rating) by both Moody's and S&P. Of the 161 split rated bonds, 104 (65%) are rated more conservative by Moody's than by S&P. In contrast, 57 (35%) of the 161 split rated bonds are rated lower by S&P than by Moody's. The extent of the differences between the split rated bonds are displayed in Table 4 using Moody's bond ratings as a benchmark.

| Table 4: Split Ratings Analysis—Fifteen Categories | | |
|---|---|---|
| **Panel A: Moody's Bond Ratings Below S&P Bond Ratings** | | |
| Total Ratings Below S&P Rating | One Rating Below S&P Rating | Two Ratings Below S&P Rating |
| 104 | 79 | 24 |
| 100% | 76% | 23% |
| **Panel B: Moody's Bond Ratings Above S&P Bond Ratings** | | |
| Total Ratings Above S&P Rating | One Rating Above S&P Rating | Two Ratings Above S&P Rating |
| 57 | 50 | 7 |
| 100% | 88% | 12% |

As indicated in Table 4, of the 104 Moody's bond ratings which were below the related S&P bond ratings, 79 (76%) were one rating below the related S&P bond rating, 24 (23%) were two ratings below the related S&P bond rating, while only one (1%) was three ratings below the related S&P bond rating. As also indicated in Table 4, of the 57 Moody's bond ratings which were above the related S&P bond ratings, 50 (88%) were one rating above the related S&P bond rating while 7 (12%) were two ratings above the related S&P bond rating. The median Moody's bond rating is Ba2, while the median S&P notch-level rating is BB+. Since Ba2 and BB+ are not equivalent ratings, we statistically evaluate the following null hypothesis and alternate hypothesis using the Wilcoxon signed-rank test.

*$H_o$: The median bond ratings assigned by Moody's is greater than or equal to the median bond ratings assigned by S&P.*

*$H_a$: The median bond ratings assigned by Moody's is less than the median bond ratings assigned by S&P.*

Based on the results of the Wilcoxon signed-rank test, we reject the null hypothesis in favor of the alternative hypothesis (Wilcoxon signed-rank S = -2292.5; $p < 0.00005$, one-tail). Stated otherwise, with respect to the sample of bond ratings included in our study, the results of the Wilcoxon signed-rank test support the conclusion that Moody's notch-level bond ratings are more conservative than the S&P notch-level bond ratings. Thus our results are consistent with the majority of the prior research comparing bond rating agencies.

As previously indicated, 161 (48%) of the bonds included in our study were assigned split ratings. Given that the bond ratings included in our study were captured at the notch-level, and given that Livingston et al. (2007) find that approximately 50% of notch-level ratings are split, the number of split ratings included in our sample is consistent with previous research. However, since the accounting studies identified above (i.e., Khurana and Raman, 2003; Brandon et al., 2004) use letter ratings—not notch-level ratings—we re-perform the above procedures using letter ratings. To accomplish this, we collapse our fifteen bond rating categories into six bond rating categories (e.g., B1, B2, and B3 were collapsed into category B for the Moody's bond ratings, etc.). The resulting bond rating distribution is reported in Table 5.

**Table 5: Bond Rating Distribution – Six Categories**

| Moody's Ratings | Number of Issues | S&P Ratings | Number of Issues |
|---|---|---|---|
| Aa and Above | 17 | AA and Above | 20 |
| A | 46 | A | 55 |
| Baa | 83 | BBB | 77 |
| Ba | 70 | BB | 59 |
| B | 100 | B | 103 |
| Caa and Below | 17 | CCC and Below | 19 |
| Total | 333 | Total | 333 |

The use of six bond rating categories (in lieu of fifteen bond rating categories) yields somewhat different results with respect to the number of split ratings. Of the 333 bonds included in our study, 263 (79%) were assigned the same letter rating by both Moody's and S&P using the six bond rating categories noted above. Consistent with the findings of Livingston et al. (2007), split letter ratings were assigned to 70 (21%) of the bonds included in our study. Of the 70 letter split rated bonds, 42 (60%) are rated lower by Moody's than by S&P by one letter rating category. The remaining 28 (40%) split rated bonds are rated lower by S&P than by Moody's by one letter rating category. The median Moody's bond rating is Ba, while the median S&P rating is BB. Please note that these median bond ratings are equivalent, whereas median bond ratings associated with the fifteen bond rating categories for Moody's and S&P were different.

Similar to the results associated with the fifteen bond rating categories, the Wilcoxon signed-rank test results associated with the six bond rating categories also support the conclusion that the Moody's bond ratings are more conservative than the S&P bond ratings (Wilcoxon signed-rank S = -248.5; p = 0.0475, one-tail) albeit at the $\alpha = .05$ level of significance versus the $\alpha = .00005$ level of significance (associated with the fifteen bond rating categories). To gain insights regarding the difference in significance levels, we performed a sensitivity analysis using a series of Wilcoxon signed-rank tests with respect to both the fifteen and six bond rating categories. The results are summarized in Table 6.

**Table 6: Wilcoxon Signed-Rank S Statistics (with Significance Levels, One-Tail)**

| Year(s) | 15 Bond Rating Categories | 6 Bond Rating Categories |
|---|---|---|
| 2004, 2005, and 2006 | -2292.5 | -248.5 |
| | (<0.00005) | (0.0473) |
| 2004 | -186 | 13.5 |
| | (0.0646) | (0.3515) |
| 2005 | -235 | -37.5 |
| | (0.0059) | (0.1141) |
| 2006 | -328 | -52.5 |
| | (<0.00005) | (0.0207) |
| 2004 and 2005 | -862 | -51 |
| | (0.0021) | (0.2884) |
| 2004 and 2006 | -1065 | -94 |
| | (<0.0001) | (0.1212) |
| 2005 and 2006 | -1114.5 | -180 |
| | (<0.00005) | (0.0071) |

For the fifteen bond rating categories, the Wilcoxon signed-rank test results are significant at the $\alpha = .01$ level for all but one of the time horizons (sub-samples) indicated in Table 6 (i.e., "Year 2004" with p = 0.0646, one-tail). Thus, in all but one instance, the results of the sensitivity analysis using fifteen bond rating categories support the conclusion that Moody's bond ratings are more conservative than the S&P bond ratings. In contrast to the fifteen bond rating category results, the six bond rating category results support the conclusion that the Moody's bond ratings are more conservative than the S&P bond ratings in only one instance at the $\alpha = .01$ significance level (i.e., "Years 2005 and 2006" with $p = 0.00705$, one-tail). Generally speaking, we believe that these contrasting results primarily stem from the difference in the categorical widths employed in the sensitivity analysis. Stated otherwise, the use of a broader categorical width to measure each of the six bond rating categories (versus the narrower categorical width used to measure each of the fifteen bond rating categories) masks the extent of the significance of split ratings and, in turn, masks the extent that Moody's bond ratings are more conservative than S&P bond ratings. Additionally, the results reported in Table 6 suggest that Moody's bond ratings become increasingly more conservative versus S&P bond ratings during the period of our study.

## IMPLICATIONS

Dandapani and Lawrence (2007) suggest that split ratings have significant financial consequences—especially at the mid range level. For example, they (p. 65) state that "…[r]egulators restrict many investment firms from investing in securities that do not receive investment ratings from at least two major rating agencies." If regulators employ at least two bond rating sources in making decisions, it would seem that accounting researchers should also consider using at least two bond rating sources—or at least state why they do not consider it necessary to use at least two bond rating sources. Use of only one bond rating source by accounting researchers is especially problematic in view of the fact that notch-level split ratings occur approximately 50% of the time (Livingston et al., 2007). Admittedly, while the extent, if any, of the potential bias associated with using only one data source has yet to be quantified, it appears that some bias exists given that a majority of the research to date suggests that Moody's bond ratings are more conservative than S&P bond ratings.

It is noteworthy that both recent accounting studies noted above (e.g., Khurana and Raman, 2003; and, Brandon et al., 2004) used letter ratings (not notch-level ratings), that is, both studies employed the broader categorical variable widths associated with letter ratings in lieu of the narrower categorical variable widths associated with notch-level ratings. Thus both of these "letter rating" studies implicitly reduced the extent of the potential bias, if any, associated with the use of only one bond rating source since letter split ratings occur approximately 20% of the time—not approximately 50% of the time as is the case for notch-level split ratings (Livingston et al., 2007). Admittedly, it would be interesting to know the extent to which differences, if any, would have resulted if both of the recent accounting studies noted above had employed notch-level ratings (versus letter rating) and/or had re-performed their analyses using another bond rating source. We suggest that accounting researchers who employ bond ratings in their studies should consider performing their analyses using multiple bond rating sources.

We note another methodological issue which could possibly bias the results of an accounting study employing bond ratings—data mixing. For example, while Brandon et al. (2004) employ Compustat accounting data to measure certain independent variables, they use Moody's bond ratings—not S&P bond ratings—as their dependent variable. Given that S&P owns Compustat, it is logical to assume that S&P employees involved in assigning the S&P bond ratings utilize data from the S&P accounting database (i.e., Compustat). Similarly, given Moody's previously affiliation with Moody's Industrial Manual (now known as Mergent's Industrial Manual), it is logical to assume that Moody's employees involved in assigning the Moody's bond ratings utilize accounting data from Mergent if for no other reason than tradition (and the fact that S&P is their competitor). However, there is a more interesting argument against mixing data in bond rating studies—Compustat standardizes its accounting data while Mergent does not, that is, Mergent employs "as reported" data in their accounting databases. We provide the following relevant excerpt regarding Compustat's standardized accounting data (www.compustat.com):

> *Our internal research team rigorously examines original company sources by carefully extracting financial information, removing reporting biases and reconciling data discrepancies. After collecting data from diverse sources, we standardize it by financial statement and by specific data item definition, preparing information that is comparable across companies, industries, time periods and sectors. This standardized presentation makes it easier to identify companies with similar characteristics, such as capital structure and operating performance and is designed to complement how the data [are] used. Additionally we analyze financial statement notes to provide detailed breakouts to gain additional insight overlooked by other companies.*

In summary, while Mergent accounting data proxy for the "as reported" accounting data found in EDGAR, this is not necessarily the case with respect to Compustat accounting data (as indicated immediately above). While the use of "standardized" versus "as reported" data in accounting studies is an issue beyond the scope of this study, we concur with the thoughts of Kern and Morris (1994) who warn that (p. 284)

> *…analysts and researchers need to exercise great care when selecting databases and variables from those databases. These choices can affect the results of and inferences drawn from empirical research in ways more than is anticipated by researchers.*

## CONCLUSION

The empirical results of our study, which are consistent with the majority of the previous bond rating research results, indicate that Moody's bond ratings are generally more conservative than S&P bond ratings. This finding leads us to suggest that accounting researchers employ multiple bond rating sources when conducting research on bond ratings to minimize the potential for bond rating agency bias. Additionally, we suggest that accounting researchers avoid mixing data sources (e.g., Compustat accounting data should be employed in studies where S&P bond ratings are employed).

Extensions of this research could focus on quantifying the extent of the bias, if any, associated with the use of only one bond rating source. Additionally, future research could focus on quantifying the extent of the bias, if any, associated with mixing data sources. Future research could also focus on quantifying the extent of the bias, if any, associated with the use of standardized versus "as reported" accounting data.

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# SHORT SELLING SUBSEQUENT TO LARGE STOCK PRICE CHANGES

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## ABSTRACT

*Financial theory demonstrates that short sellers must be better informed traders than typical investors given the constraints faced by these sellers. We explore whether short sellers in NASDAQ stocks are better informed by examining whether there are significant changes in short interest around extreme returns and whether these changes are consistent with informed trading. In our sample, we find that there are some extreme returns that elicit changes in short interest, some of which appear to be driven by informed trading. The overall pattern of changes we observe, however, is not consistent with the notion that most short sellers possess superior information.*

## INTRODUCTION

> *"This is how short selling can work. You have a small number of people who believe the market is heading down. They act. Then a greater number of people act out of fear. This accelerates the effect. If one creates the right circumstances for downward market movement, one can make money by short selling-by selling a security at a price that tomorrow will be overmarket."* (Sabin Willett in *Present Value* (p 124)

Short sellers are better informed traders. This conclusion follows naturally from theoretical models of short selling (e.g., Diamond and Verrechia 1987, and Fabozzi and Modigliani 1992) that demonstrate that in the presence of short sales constraints, short selling would exist only if superior information is possessed by such traders. Early empirical studies (Conrad 1986, Senchack and Starks 1993, Asquith and Meulbroek 1995, and Desai, Ramesh, Thiagarajan, and Balachandran 2002) reinforce this notion by showing that announcements of large changes in short interest are associated with negative announcement and/or longer-term abnormal returns. Thus, stock returns following short sale announcements are used to infer that short sellers possess superior information.

These empirical conclusions, however, cannot be differentiated from uninformed trading resulting from psychological biases that affect asset pricing (see Hirshliefer 2001 for an overview). Such biases can create a herd mentality among investors and lead to self-fulfilling propheciesinvestors believe short sellers *must* be better informed and trade the stock of firms targeted by short sellers. Thus, early empirical evidence associated with stock return patterns does not distinguish superior information of short sellers from herding behavior by investors observing the trades of short sellers.

More recent empirical studies attempt to more definitively determine whether short sellers are better informed traders. Boehmer et al. (2008) examine transaction-level short sales of NYSE firms and find that stocks with higher levels of short selling underperform less-shorted stocks over the subsequent trading month. Further, short sales by institutional traders appear to be better informed than short sales by other traders. Other empirical studies, however, question the extent to which short sellers possess superior information, particularly for short selling in NASDAQ firms.

Christophe, Ferri and Angel (2004) find that there are increases in short selling activity prior to earnings announcements for NASDAQ firms with negative earnings surprises, particularly for announcements that generate negative abnormal returns. The authors also find similar short sales activity, however, for firms with positive earnings surprises, which is inconsistent with informed trading. In similar research utilizing NASDAQ firms, Mercado-Mendez et al. (2006), find that the level of short interest tends to increase prior to both negative *and* positive earnings surprises. Further, immediately prior to the earnings announcement, the level of short interest is consistently higher for firms with *positive* earnings surprises. Additional evidence regarding short selling behavior for NASDAQ stocks is in Best et al. (2008), who examine whether short sellers anticipate large (one-day) stock returns. In general, the authors conclude that there is little or no evidence that short sellers can predict these returns. On the other hand, Diether et al. (2005) suggest that some short sellers are able to predict negative abnormal returns over one to five day horizons. Given the authors' use of levels of, instead of changes in, short sales and the regression methodology employed, the extent to which short sellers are *adjusting* short positions remains unclear.

If Best et al. (2008) are correct and short sellers of NASDAQ firms do not (on average) trade using superior information, it is unclear exactly what information might be used by short sellers to target a particular firm. Grinblatt and Keloharju (2001), using Finnish stock market data, find that investors' trading is influenced by (among other factors) prior stock returns and whether the stock is at a monthly high or low. Further, Odean (1999) analyzes investors' trading behavior and finds that investors (on average) not only misconstrue information but appear to draw incorrect conclusions about the meaning of that information. Thus, investors appear to act on trading "triggers" but seem to trade in an incorrect manner based on these triggers. It is plausible, therefore, that short sellers also trade based on identifiable signals. Indeed, Best et al. (2008) document, but do not explore, an increase in short interest after firms experience large one-day stock returns. Thus, we examine more formally whether changes in the level of short interest follow a predictable pattern after large (one-day) stock returns for NASDAQ firms.

If large returns serve as signals to trade, changes in short interest following these returns should predict future returns if short sellers are better informed traders. Thus, our second line of inquiry is whether short selling activity immediately after large stock returns is correlated with future stock returns. Previous research has indicated that large (one-day) returns could prove profitable as a trading signal for short sellers. DeBondt and Thaler (1985, 1987) and Li (1998) demonstrate the availability of contrarian profits via the tendency for returns to revert on average. Because this is an average effect, many firms in their samples do not experience such reversals. If short sellers possess superior information, and Boehmer et al.'s (2008) findings for NYSE firms apply across exchanges, we would expect short sellers to be able to differentiate between NASDAQ firms that will and will not experience price reversals following large one-day returns.

## DATA AND METHODOLOGY

To explore whether large returns trigger short sales in NASDAQ firms, we collect a sample of firms that experience "extreme" one-day returns. Because of the publicly available short sales data from NASDAQ, our sample is limited to the period July 1998 - September 2002. We exclude September 2001 from the sample, and we further limit our study to firms that have an average daily trading volume of at least 100,000 shares, lessening the likelihood that share availability and borrowing costs impact the trading of short sellers. To determine the trading behavior of short sellers following large returns, we focus our sample collection on one day from each month. Short interest on NASDAQ is typically released to the public on the 21$^{st}$ of each month. The actual compilation date, however, is the 15$^{th}$ day of each month. In reality, there is a three-day settlement period and short sales compiled on the 15$^{th}$ are those that have actually settled on that date, implying that open short interest reported on the 21$^{st}$ reflects all short sale trades that have occurred three days prior to the 15$^{th}$ of the given month. Note also, that if the 15$^{th}$ is on a weekend or holiday, the compilation date is always the last trading day prior to the 15$^{th}$. The date we use to collect our sample of extreme returns is the trading day prior to the last trade date for reported short sales for the given month. Thus, for example, if the 15$^{th}$ is the reporting date (and is a Friday), the NASDAQ-reported short sales would be for trades that occurred on or before the 12$^{th}$. We use stock returns on the 11$^{th}$ to form our sample, ensuring that reported short interest reflects trading activity that might result from the extreme return.

We next identify the two firms with the largest positive returns and the two firms with the most negative returns on the correct day (as outlined above) for each month of our study. Our initial sample has 100 firms with (extreme) negative and 100 firms with (extreme) positive one-day returns. We include in our final sample only those firms that meet our data availability requirements. First, the firm must have short interest data available from NASDAQ during the month of the extreme return and the month prior to the extreme return. Second, the number of shares outstanding for the firm must be available from the Center for Research in Securities Prices (CRSP) database for the month of and month prior to the extreme return. Finally, the firm must have at least four months of daily returns available from the CRSP database prior to the date of the extreme return. There are 86 firms with extreme negative returns and 81 firms with extreme positive returns that meet our criteria.

Our first investigation centers on whether short sellers use extreme returns as signals to trade. Akhigbe, Gosnell and Harikumar (1998) document short-term price reversals for firms experiencing extreme one-day returns. If prices revert, we suspect informed short sellers to increase short positions following large positive returns and reduce positions following large negative returns. We measure short interest each month as the total reported shares sold short divided by total shares outstanding and calculate the change in short interest as short interest in the month of the large return minus short interest in the month prior to the large return. Because the large return occurs immediately before the short interest 'last trade' date (for reporting purposes), any significant changes in short interest are likely related to the extreme return.

Because not all large one-day returns are followed by price reversals, we also explore whether short sellers can distinguish among firms that have a subsequent price reversal versus those that do not. If short sellers are better informed traders that use a large one-day return as a signal to trade, we expect to find increases in short interest for firms that have large positive returns immediately followed by price reversals. Similarly, for firms that experience large negative returns followed by subsequent negative returns, we also should observe increases in short interest. On the other hand, large negative returns followed by reversals and large positive returns followed by positive returns should generate reductions in short interest around the one-day return date, if short sellers are better informed traders.

We measure subsequent return as the compounded total return over the three trading days immediately following the short interest last trade date. We use the three day window for two reasons. First, Akhigbe et al. (1998) show price reversals tend to exist (on average) for several days after the large return. Second, this trading period occurs before NASDAQ publishes short interest for the month. Thus, these returns are not influenced by investors' reactions to announcements of changes in the level of short interest, eliminating the possibility that the stock return is driven by herding behavior of other investors.

To supplement our short sales analysis, we also explore whether short selling is influenced by the presence of news accompanying the one-day extreme return. Our sample period is one of high volatility in stock returns, implying an individual stock may experience extreme returns as a result of market-based factors instead of company-specific information. Thus, we search the Lexis-Nexis newswire service to identify extreme returns with news events. We then analyze the pattern of short interest for firms with returns "caused" by a news event versus firms with large returns that do not have any accompanying news.

As a final statistical test, we use regression analysis to provide insight into whether short sellers use large one-day returns as signals to trade and whether trading behavior is consistent with informed trading. With this approach, we are able to control for various factors that might influence short selling behavior. In particular, Best et al. (2006) find that level of short interest is related to the prior (longer-term) return of the firm, and the change in short interest is influenced by the standard deviation of these prior returns and the natural log of shares outstanding. Thus, we include the natural log of shares outstanding to control for effects of share availability. We also calculate the compounded total return of the firm for the 125 days immediately prior to large return date and the standard deviation of these returns to include in our regression analysis.

## EMPIRICAL FINDINGS

In Table 1, we present descriptive information regarding the sample of firms divided by whether the firm had an extreme negative return ("negative firms") or extreme positive return ("positive firms"). We also provide the results of tests for differences in some of these variables. To maintain correct distributional assumptions, we conduct t-tests on the natural log of the return, short interest and volume measures. As shown, the average trading volume and level of short interest prior to the large return are similar for the negative and positive firm subgroups. The average firm in our sample experiences large (positive) returns over the 125 trading days immediately prior to the large one-day return regardless of whether the one-day return is positive or negative. As the medians indicate, however, the distribution of prior returns is highly skewed. The median prior return for the negative return firms is essentially zero, while the median prior return for the positive return firms is -39.9%. Overall, the prior return of the negative firms is significantly greater than the prior return of the positive firms, while the standard deviations of the prior returns across negative and positive firms are essentially identical.

There are two interesting observations that arise from Table 1. First, the firms in our sample that have one-day (large) negative returns do not, on average, experience a price reversal over the three-day period immediately following the short sales last trade date. The positive-return firms, however, experience significantly negative returns over this three day window on average (this test, not reported in Table 1, has a p-value of 0.004). Note, however, that the average Apost@ return of the positive firms cannot be distinguished statistically from the average post return of the negative firms. Second, the average firm in our sample has an increase in short interest immediately following the large one-day return regardless of whether the one-day return was negative or positive. The positive return firms, however, have a statistically larger increase in short interest than do the negative return firms. Given the preponderance of the positive return firms to experience reversal, this might indicate that short sellers use large one-day returns as trading triggers.

**Table 1: Descriptive Statistics by One-Day Return**

| | Negative One-Day Returns | Positive One-Day Returns | Test for Differences |
|---|---|---|---|
| Sample Size | 86 | 81 | |
| Daily Trading Volume | 584,684 | 374,507 | 0.76 |
| | [207,288] | [215,814] | (0.45) |
| One-Day "Large" Return | -17.20% | 25.70% | **20.88** |
| | [-15.30] | [21.90] | (0.00) |

| Table 1: Descriptive Statistics by One-Day Return | | | |
|---|---|---|---|
| | Negative One-Day Returns | Positive One-Day Returns | Test for Differences |
| Short Interest in Month Prior to Large Return | 5.60% | 5.90% | 0.27 |
| | [4.40] | [3.00] | (0.79) |
| Return over the 125 Trading Days Prior to Large Return | 119.80% | 75.00% | **2.18** |
| | [-0.50] | [-39.90] | (0.03) |
| Standard Deviation of Prior Return | 8.60% | 8.60% | |
| | [7.00] | [8.00] | |
| Percentage Point Change in Short Interest (month of large return - month prior) | 0.45 | 1.40 | **1.84** |
| | [0.18] | [0.30] | (0.07) |
| Compounded Raw Return for 3 Trading Days after Large Return | -0.10% | -3.40% | 1.40 |
| | [0.00] | [-2.50] | (0.164) |

Means [Medians] appear in the table. Tests for differences are t-tests on the natural logs of return measures, volume, and level of short interest. P-values are in parentheses, and bold font indicates statistical significance.

That short sellers would use large returns to initiate trades alone is not evidence of informed trading. Thus, we divide the negative return firms and positive return firms by whether the firms experience price reversals over the three-day trading window after the large one-day return. This gives us four categories of firms: (1) Firms with extreme negative one-day returns followed by further negative returns, (2) Firms with extreme negative one-day returns followed by positive returns, (3) Firms with large positive one-day returns followed by negative returns, and (4) Firms with large positive one-day returns followed by more positive returns. If short sellers trade on the basis of superior information, and if large one-day returns trigger trading, we expect to see reductions in short interest for firms that are in categories (2) and (4) and increases in short interest for firms in categories (1) and (3).

In Table 2, we report the change in short interest immediately following the large one-day return for each of these categorizations. We also include the results of t-tests that indicate whether the short interest changes are individually significantly different from zero and whether the changes in categories (1) and (3) are significantly greater than the changes in (2) and (4) respectively. Consistent with predictions (if short sellers are better informed), there are significant increases in short interest for firms with extreme negative one-day returns followed by further negative returns (p-value = 0.039) and for firms with large positive one-day returns followed by negative returns (p-value = 0.011). Further, these changes in short interest are statistically greater than changes in short interest for firms that experience subsequent positive returns. Thus, short sellers appear to anticipate future negative (short-term) returns after a large one-day price change. We note, however, that there are not significant declines in short interest for firms in our sample that have subsequent positive returns. Statistically, short interest does not change for these firms. If short sellers are better informed traders, we cannot explain this result nor its inconsistency with the apparently informed trading that occurs for firms with subsequent negative returns.

| able 2: Average Change in Short Interest Following Large One-Day Return | | |
|---|---|---|
| | Sign of One-Day Large Return | |
| Sign of Subsequent Return | Negative | Positive |
| Negative | **0.808** | **1.828** |
| | [43] | [51] |
| | (0.039) | (0.011) |
| Positive | 0.095 | 0.700 |
| | [43] | [30] |
| | (0.757) | (0.104) |
| T-Test for Differences (Ho: SI negative subsequent # SI positive subsequent) | **1.470** | **1.404** |
| | (0.073) | (0.082) |
| Change in short interest (SI) is calculated as percentage SI immediately following the large (one-day) return minus percentage SI in the prior month. Sample size for each category is in brackets and p-values are in parentheses. For the average change in SI, the null hypothesis is that the change in SI equals zero. Bold font indicates statistical significance. | | |

We next examine whether the existence of a specific event influences short selling behavior around these extreme returns. In Table 3, we divide the sample into those firms with and without news at the time of the extreme return. We further divide our sample based on the sign on the one-day return and the sign of the subsequent return. We confirm that positive (extreme) returns followed by negative returns have significant increases in short interest *regardless* of whether news accompanies the extreme return. However, two new results emerge.

| Table 3: Average Change in Short Interest by Return Type and Accompanying News | | |
|---|---|---|
| | One-Day Return Accompanied By | |
| Return Type | No News | News |
| **Negative** Large Return followed by **Negative** 3-day (Subsequent) Return | 0.886 | 0.719 |
| | (0.132) | (0.196) |
| | [23] | [20] |

| Table 3: Average Change in Short Interest by Return Type and Accompanying News | | |
|---|---|---|
| | One-Day Return Accompanied By | |
| Return Type | No News | News |
| **Negative** Large Return followed by **Positive** 3-day (Subsequent) Return | **1.124** | -0.457 |
| | (0.017) | (0.246) |
| | [15] | [28] |
| **Positive** Large Return followed by **Negative** 3-day (Subsequent) Return | **3.086** | **1.017** |
| | (0.060) | (0.087) |
| | [20] | [31] |
| **Positive** Large Return followed by **Positive** 3-day (Subsequent) Return | 0.057 | 1.191 |
| | (0.858) | (0.491) |
| | [13] | [17] |

No news indicates that there was no identifiable news event (from Lexis-Nexis newswire search) accompanying the large (one-day) return. News indicates that specific news related to the company appeared at the time of the large return. Average change in short interest (SI) is average SI immediately after the large return for firms with the specific return type minus average SI in the month prior to the large return for the same firms. P-values are in parentheses, brackets contain number of observations, and bold font on numbers indicates the value is statistically different from zero.

First, the increases in short interest for firms with negative extreme returns followed by negative returns are no longer statistically significant when we divide the sample by news or no news. Two factors likely contribute to this finding-the smaller sample sizes reduce the power of the simple parametric tests, and short selling is likely more difficult surrounding large negative returns because of the optic rule that requires an increase in price before a short sale can be made. Second, and somewhat puzzling, is that there are significant increases in short interest around negative extreme returns followed by positive returns if no news event exists. This result is consistent with short sellers using a large return as a signal to trade (in the absence of other information) *if* these traders expect a price reversal. While such speculative behavior is rational given the propensity of stocks to price-revert, this behavior is not consistent with informed trading by short sellers.

Finally, we use regression analysis to examine the relationship between short selling and extreme returns while controlling for other factors that may also influence changes in short interest. The coefficient estimates (and p-values of tests for difference from zero) are in Table 4. We conduct three regressions where the dependent variable for each is the change in short interest that occurs immediately after the large return. In the first regression, we use only the one-day (extreme) return as the independent variable. In the second regression, we use one-day return, a dummy variable to indicate whether the subsequent return is negative, the (six-month) daily compounded prior return, standard deviation of these prior returns, and the natural log of shares outstanding. In the final regression, we include (from the second regression) the six-month prior return, standard deviation of returns, and natural log of shares outstanding along with seven dummy variables to indicate the signs of the extreme returns and subsequent returns based on whether there was news or no news (similar to the categorizations in Table 3). For example, the first dummy variable takes on a value of one if the extreme return is negative, is followed by a negative return, and has no news simultaneous with the extreme return. The category not indicated by a dummy variable is the positive extreme return, followed by a positive return, accompanied by news.

In the first regression, we confirm that the one-day return is significantly positively related to the change in short interest immediately following the large return (p-value=0.051). Thus, on average, large positive returns lead to increases in short interest while large negative returns (presumably) lead to decreases in short interest. In the second regression, we find that the large one-day return remains significantly related to the change in short interest in the presence of other (control) variables. Interestingly, when we include the (6-month) prior return, standard deviation of prior return, and natural log of shares outstanding in the regression, the coefficient on the dummy variable indicating subsequent negative returns becomes insignificant. We also find that the coefficient for the prior return is significantly positive, while the coefficient for shares outstanding is significantly negative. This implies that short sellers use a large one-day return in combination with the prior return of the firm to adjust short positions, and these adjustments are more dramatic (relative to shares available) for firms that have *fewer* shares outstanding. Increases in short interest, however, do not appear to predict subsequent negative returns.

In the final regression, we use a combination of dummy variables instead of the magnitude of the extreme return and dummy variable for subsequent negative return. In this regression, only three of the independent variables have significant coefficients. Similar to the second regression, both the prior return and shares outstanding variables have significant coefficients. Of the dummy variables, only the indicator of a negative extreme return followed by a positive return with the presence of news has a significant coefficient. The negative sign implies that, after controlling for the firm's prior return and level of shares outstanding, firms falling into this classification experience declines around the news event. This is indicative of short sellers (rationally) closing short positions after a sharp decline in stock price. Given the lack of significance of other dummy variables, however, we question whether short sellers trade on superior information or simply use observable events as trading triggers in order to speculate on future returns.

| Table 4: Estimated Regression Coefficients | | | |
|---|---|---|---|
| | Regression Number: | | |
| Variable | One | Two | Three |
| Intercept | **0.848**[a] | **9.328**[a] | **10.327**[a] |
| One-Day Return | **1.898**[c] | **1.566**[c] | |
| Prior Return | | **0.178**[a] | **0.159**[b] |
| Std Dev of Prior Return | | -0.624 | 0.545 |
| Ln(Shares Outstanding) | | **-0.825**[a] | **-0.822**[a] |
| Negative Subsequent Return | | 0.398 | |
| No News D (neg-neg) | | | -1.020 |
| No News D (neg-pos) | | | -0.448 |
| No News D (pos-neg) | | | 0.707 |
| No News D (pos-pos) | | | -1.561 |
| News D (neg-neg) | | | -1.117 |
| News D (neg-pos) | | | **-1.961**[b] |
| News D (pos-neg) | | | -0.830 |
| Adjusted $R^2$ | 0.017 | 0.154 | 0.165 |
| F-statistic | **3.880**[c] | **7.050**[a] | **4.292**[a] |

The dependent variable is percentage short interest (SI) immediately following the large (one-day) return minus percentage SI from the prior month. One-Day Return is the large return, Prior Return is the compounded daily return for the 125 trading days immediately prior to the large return, Std Dev of Prior Return is the sample standard deviation of the Prior Return, Ln(Shares Outstanding) is natural log of shares outstanding in the month of the large return, and Negative Subsequent Return is a dummy variable equal to one if the return over the 3 trading days after the large return is negative. "D" indicates a dummy variable equal to one if the other conditions are met. For example, "No News D (pos-neg)" equals one if there is no news accompanying the large return, the large return is positive, and the subsequent 3-day return is negative. Bold font indicates statistical significance, and a, b, c represent significance at the 1%, 5%, and 10% level respectively.

## CONCLUSIONS

We remain puzzled by the apparent lack of informed trading on the part of short sellers. While our results provide evidence similar to Boehmer et al's (2008) finding for the NYSE that some short sellers may predict future negative returns, we also note evidence that short sellers get it wrong. Thus, not all short sale transactions surrounding large one-day returns appear to be driven by informed trading. Based on our current findings, we must conclude that much short selling simply results from speculative trading, not informed trading.

This conclusion must be considered in two lights. First, because we use monthly short sales data, we cannot confirm with 100% that our changes in short sales are driven by the large return (other factors may have led to an increase in short interest prior to the occurrence of the extreme return). The third regression of Table 4 is consistent with the notion that short sellers use longer-term returns to formulate short sale positions. Second, we are unable to identify and/or isolate short sellers who open and close positions over a single day. These "day traders" may be engaging in informed trading. Based on our sample, however, there appears to exist many short sellers in NASDAQ stocks whose trades are inconsistent with informed trading.

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