

Individual Investors' Financial Literacy and Numerical Skills

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General research question

How does the broader range of investors' financial and quantitative skills impact extant accounting research results?

Understanding the impact on individual investors is a common behavioral financial research motivation.

Yet, we know relatively little about how individual investors' skill sets impact their interpretation of financial situations.

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*How does the broader range
of investors' financial and quantitative skills
impact their assessment of incentive conflicts of
interest in financial situations?*

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Why care about individual investors?

- **Regulators are concerned for the individual investor**
 - Financial reporting issues vs. financial accounting standards
 - e.g., understanding conflicts of interest
- **Individual investors are important in capital markets**
 - Individuals owned ~25% of U.S. equities in 2009 (NYSE 2010)
 - Presence can affect market prices and expectations
 - e.g., Hirshleifer et al 2006; DeLong et al 1990a, 1990b; Shleifer and Vishny 1997, among others
 - Importance of individual investors may be greater for particular components of the market
 - e.g., Jiang et al 2013 : U.S. Pink Sheets market (together with OTCBB was \$846 billion in 2005, >2x size of AMEX)
 - e.g., JOBS Act: crowdfunding

Why care about this research?

1. Document range of investor skills and perceptions

- Consider the broader individual investor population
 - Financial literacy and related numerical skills
 - Education-based proxies for investment experience
- Reconcile accounting research participants with SEC Staff (2012):
“American investors lack even basic financial literacy knowledge and skills”

Why care about this research?

- 2. Benchmark investors on MTurk against national samples** (FINRA Foundation 2009a, 2009b)
 - Extend general demographics (e.g., Buhrmester et al. 2011, Paolacci et al. 2010) to focus on investors, their financial literacy and related skills, benchmarked to nationwide representative samples
 - Extend replications (Koonce et al 2014, Farrell et al 2014 WP, Owens 2014 WP) to assess characteristics that assist in replication

- 3. Assess impact of broadening range of participant skills on accounting research findings**
 - Conflicts of interest due to incentives is an important research theme
 - Use of subset when restricted sample arguably not applicable

The Individual Investor

- ... is more likely to be older, male, employed full-time, educated, and engaged in retirement planning.
- ... is more confident than non-investors, and not without reason, with better financial literacy, numeracy, quantitative reasoning.
- ... is relative sophisticated compared to non-investors, but relative unsophisticated compared to specialized sample.

Education-based proxy limits generalizability
(6% of population and < 10% of investors)

So, what?

- **Results of three extant research studies on incentive conflicts of interest**
 - Moderated by investment experience
 - Within investor subsample, moderated by numerical skills
- **Carefully consider research context and motivation**
 - Potential match between applied theory, population of interest, and participant pool
- **Benchmarking suggests MTurk can provide a viable participant pool, conditional on:**
 - Investment-based screening questions
 - Numerical skills or educational background

Background

- **SEC Staff [2012] study:**
 - American investors lack even basic financial literacy knowledge and skills (compound interest, inflation, diversification)
- **Accounting Research:**
 - **Graduate Business Students**
 - e.g., Hirst, Koonce and Simko (1995)
 - First year MBAs with 2+ years of work experience
 - Multiple accounting (4) and finance (2) classes
 - Vast majority (94%) indicate common stock investment or plan
 - **Investment club members**
 - e.g., DeBondt (1998), Hodge (2003), Elliott et al. (2008)
 - Female (?), older (50+), 70-75% college educated

Who is An Investor?

- **Multiple definitions applied across studies**

- Adults who invest in stocks, bonds and/or mutual funds, outside of an employer-sponsored retirement plan

Abt SRBI 2008

- Performed at least one stock, bond, or mutual fund transactions in the past six months

Applied Research Consulting 2003

- Person who makes decisions about where their savings are place including CDs, stocks, bonds and mutual funds

Opinion Research Corporation 2007

- 401K retirement savings

Hung et al. 2009

Research Questions 1 and 2

- RQ1: How does the distribution of demographic characteristics and numerical skills differ in **investors relative to non-investors**, under alternative definitions of “an investor”?
- RQ2: How does the distribution of demographic characteristics and numerical skills differ in **investors relative to education-based proxies for investment experience**, under alternative definitions of “an investor”?

Financial literacy and numerical skills

- **Fundamental financial knowledge or understanding**

- Lusardi and Mitchell

- Research

- e.g., Almenberg and Widmark (2011), Li et al. (2011), many others

- Nationwide surveys

- e.g., FINRA Foundation (2009a, 2009b, 2012)

- *“knowledge of basic financial concepts, such as the working of interest compounding, the difference between nominal and real values, and the basics of risk diversification”*

Lusardi (2008, p.2)

Financial literacy: Examples

- **Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?**
(More than/Less than/Exactly \$102) ~79%
- **Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?**
(More than/Less than/Same as today) ~67%
- **If the interest rate falls, what should happen to bond prices?**
(Rise/Fall/Stay the same) ~30%
- **Buying a single company's stock usually provides a safer return than a stock mutual fund. (True/False)** ~54%
- **A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. (True/False)** ~79%

Related Numerical Skills

- **Financial literacy** (finance and economics literatures)
 - Working knowledge of basic financial concepts
- **Accounting literacy**
 - Financial literacy within accounting literature
 - Ability to read and understand fundamental financial statements
- **Numeracy or Numerical literacy**
 - Working knowledge of fundamental probability and numerical concepts
- **Quantitative Analytical Reasoning**
 - Ability to break down a situation in order to see patterns and solve associated problems

Research Questions 3 and 4

- RQ3: Does **investment experience** moderate the expected influence of incentives on judgment for a sample of extant accounting research studies on incentive conflicts of interest?
- RQ4 How do participants' **numerical skills** affect the impact of investment experience on the sample of accounting research findings on incentive conflicts of interest?

Understanding Others' Incentives

- **Fundamental to (at least) two streams of accounting research:**
 - Conflicts of interest (in context: financial advisors)
 - Earnings management
- **In a financial setting, knowledge of incentive effects is more likely with related financial experience.**
- **Persuasion Knowledge Model** (Friestad and Wright 1994)
 - Topic knowledge
 - Persuasion knowledge, which may be context-specific

Method

Amazon MTurk sample, >2,000 participants

I. Characteristics and financial literacy, benchmarking investor subsample against:

- National samples
 - FINRA Investor Education Foundation, in consultation with U.S. Department of the Treasury, President's Advisory Council
 - State-by-State (FINRA 2009a): > 25,000 respondents
 - National (FINRA 2009b): ~1,500 respondents
- Convenience sample of graduate business students (N=45)

II. Impact on accounting decision-making

- Randomized across between-subject conditions in selection of extant accounting research studies

The World of MTurk

- **Requesters post tasks (“HITs”) that are visible only to workers who meet predefined criteria**
 - E.g., country of residence, accuracy in previous tasks
 - Other criteria can be assessed in initial survey screens
- Workers can read brief descriptions and preview tasks before accepting them.
- Requesters can reward good work with bonuses and punish poor quality work by refusing payment.
- Workers and Requesters are generally anonymous
 - Unique Worker ID provided by Amazon

Recruiting on MTurk

- **HIT**
 - Survey: How do you decide things?
 - General problem-solving, plus decision-making in a business / investment setting
- **Worker eligibility**
 - Prior HIT approval rate for all requesters > 95%
 - Worker location in US
 - Plus: Age at least 18 years (within Qualtrics)
- **\$1 payment for completion** (effectively \$2.09/hr)
 - Payment levels tend to affect length of data collection rather than data quality (Buhrmester et al. 2011)
- **90 minute maximum time limit**
- **2,000 assignments** (unique Workers)
- **Data collection completed in approximately 5 days**

Survey Design

- **Introduction**
 - Includes **financial confidence (FINRA Foundation)**
- **Experiment replication**
 - Randomized across between-subject conditions for three existing research studies on incentive conflicts of interest
- **Demographic variables and numerical skills (Appendix A)**
 - **Demographic variables**
 - **Financial literacy (FINRA Foundation)**
 - Numeracy, Quantitative analytical reasoning, Selected other
- **Follow-up HIT for investors: Accounting Literacy**

National Samples (FINRA 2009a, 2009b)

- **Demographics**
 - gender, age, education level, employment, home ownership, income
- **Financial capability (e.g., accounts, debts)**
- **Financial literacy**
 - Five question “quiz” based on Lusardi and Mitchell
- **Financial behaviors (e.g., credit card habits, access to professional financial advice)**
- **Financial attitudes**
 - Four questions related to confidence
 - Risk preferences

Financial literacy

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Financial confidence

- Rated agreement with each of three statements
 - Seven-point scale (“Strongly Disagree” to “Strongly Agree”)
 - (1) I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses;**
 - (2) I am pretty good at math;**
 - (3) I regularly keep up with economic and financial news.**
(omitted from FINRA Foundation 2012)
- **Self-assessed overall financial knowledge**
 - Seven-point scale (1 - 7),
1 means "Very Low" and 7 means "Very High."

Investor Classifications

- **MTurk:**

- Have you ever invested in... (Choose all that apply.)

- Individual company stocks

- Yes, directly

- Yes, through a pension or formal retirement account

- No

- Mutual funds

- Yes, directly

- Yes, through a pension or formal retirement account

- No

- **FINRA Foundation:**

- **Not including retirement accounts**, do you (does your household) have any investments in stocks, bonds, mutual funds, or other securities?

- How much of your (household's) **retirement portfolio** is invested in stocks or mutual funds that contain stocks?

- (Converted to identifier; omitted from FINRA Foundation 2012)*

Extended skills: Numeracy

Basic Numeracy (Schwartz et al. 1997) – Adapted to multiple choice

- Imagine that we flip a fair coin 1,000 times. What is your best guess about how many times the coin would come up heads in 1,000 flips?
- In the BIG BUCKS LOTTERY, the chance of winning a \$10 prize is 1%. What is your best guess about how many people would win a \$10 prize if 1,000 people each buy a single ticket to BIG BUCKS?
- In ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets to ACME PUBLISHING SWEEPSTAKES win a car?

Extended skills: Numeracy

Higher-Order Numeracy (Cokely et al. 2012) – Multiple choice

- Imagine we are throwing a five-sided die 50 times. On average, out of these 50 throws how many times would this five-sided die show an odd number (1, 3 or 5)?
- Out of 1,000 people in a small town, 500 are members of a choir. Out of these 500 members in the choir, 100 are men. Out of the 500 inhabitants that are not in the choir, 300 are men. What is the probability that a randomly drawn man is a member of the choir? Please indicate the probability in percent
- Imagine we are throwing a loaded die (6 sided). The probability that the die shows a 6 is twice as high as the probability of each of the other numbers. On average, out of these 70 throws how many times would the die show the number 6?
- In a forest, 20% of mushrooms are red, 50% brown and 30% white. A red mushroom is poisonous with a probability of 20%. A mushroom that is not red is poisonous with a probability of 5%. What is the probability that a poisonous mushroom in the forest is red?

Extended skills:

Quantitative analytical reasoning

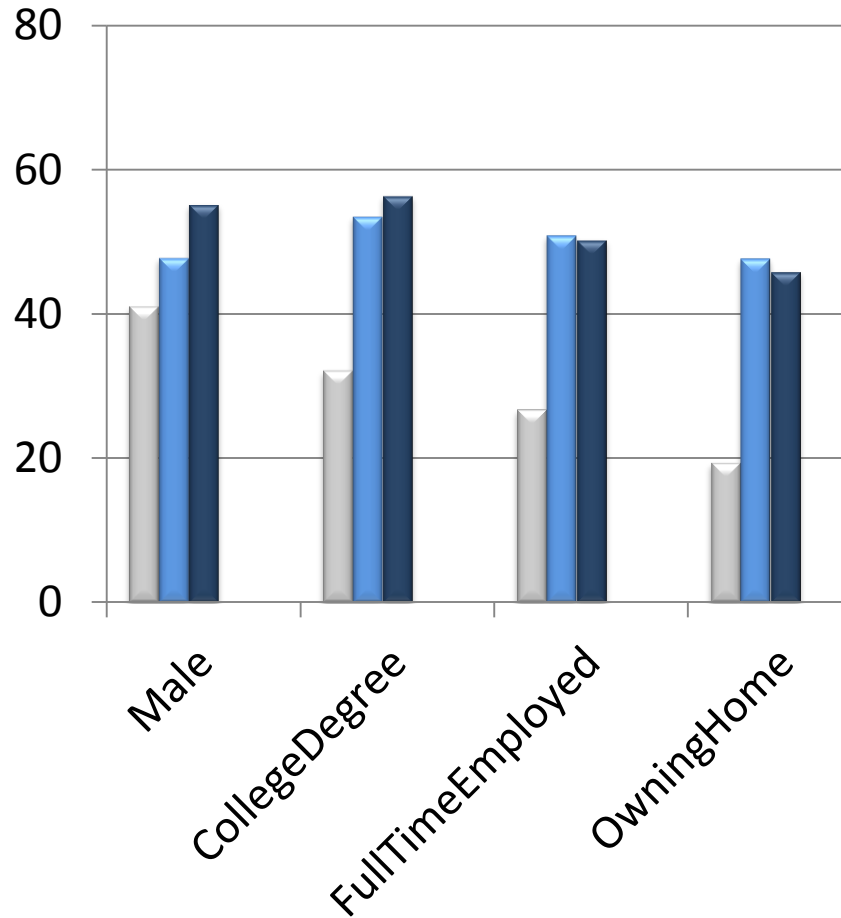
Cognitive Reflection Test (Frederick 2005) – Adapted to multiple choice

- A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?
- If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
- In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Effects of Investment Proxy and Numerical Skills

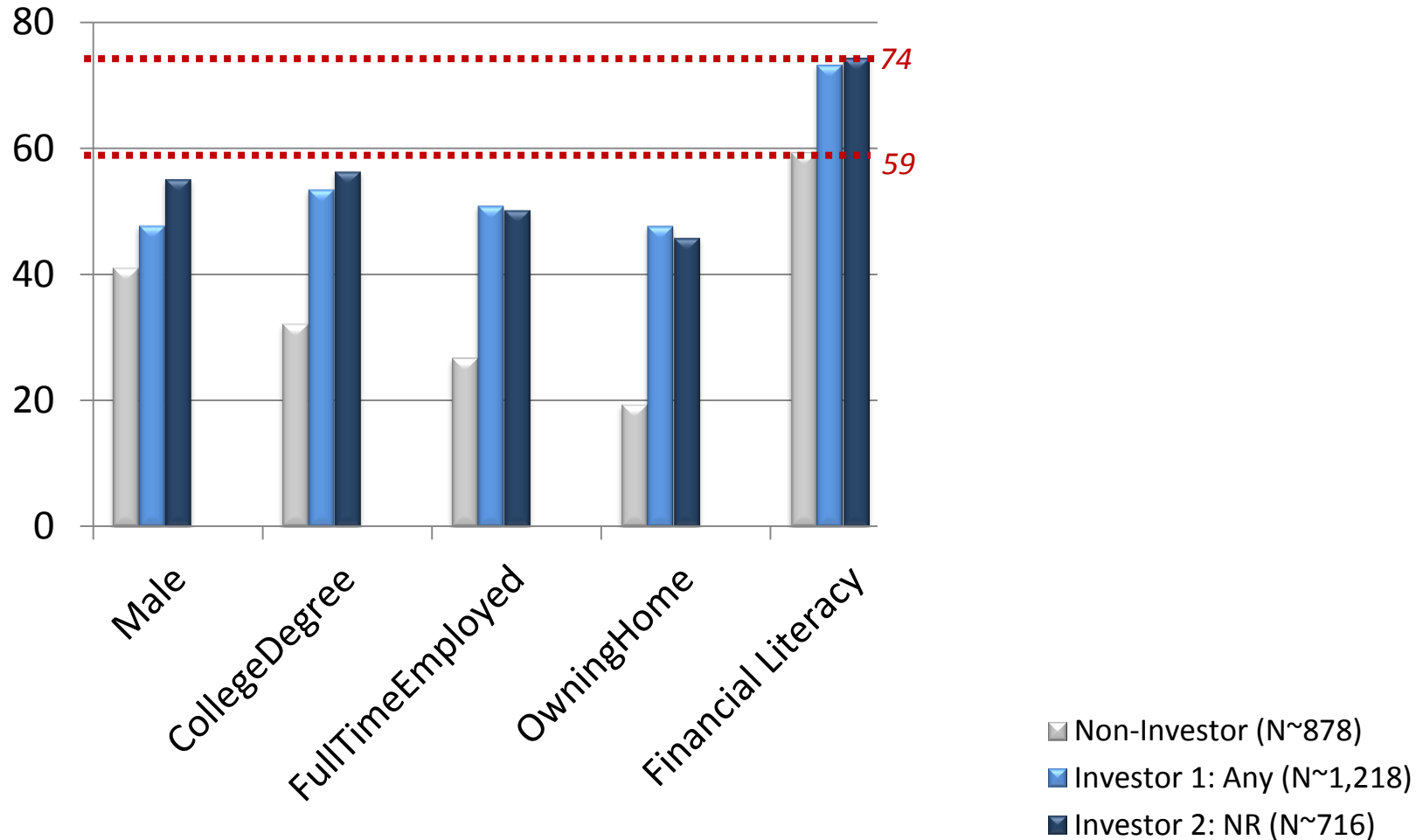
- **Randomized across between-subject conditions for three existing research studies on conflicts of interest :**
 - Elliott et al.'s (2007 TAR) Experiment 1
 - Kadous et al.'s (2005 CAR) Experiments 1 and 2
 - Nelson & Rupar's (2011 WP) Experiment 1
- **Focus in the current research is on impact of investment experience and numerical skills**
 - Elliott et al. purposefully examined whether MBA students represent valid proxies for investors (NAIC)
 - Kadous et al., and Nelson & Rupar both provide replications
 - MBA students as participants
 - Theory similar to Elliott et al. regarding conflicts of interest in accounting settings
 - Nelson & Rupar extends investigation to more technical financial context

Effect of Investor Classifications (Table 1)

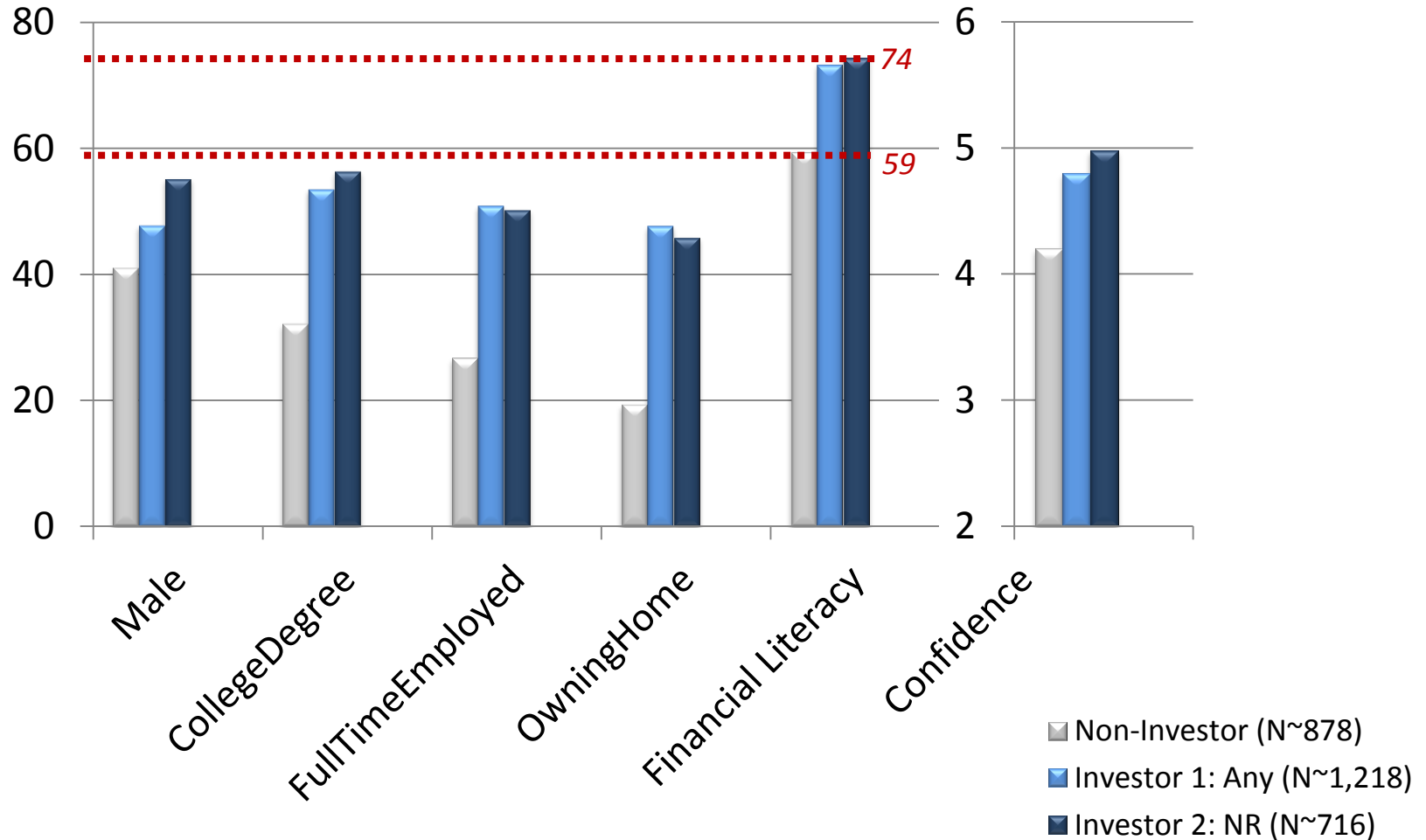


- Non-Investor (N~878)
- Investor 1: Any (N~1,218)
- Investor 2: NR (N~716)

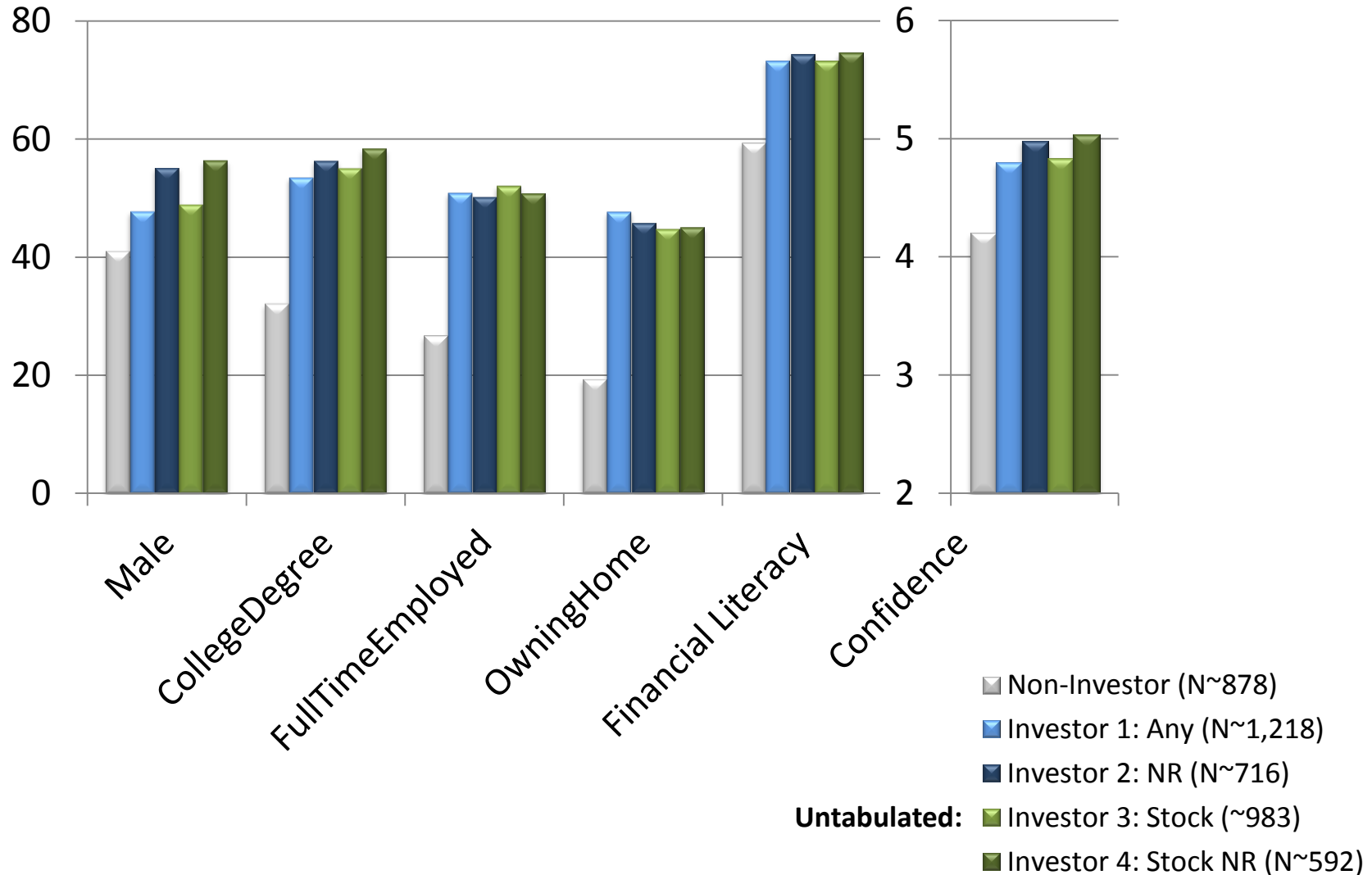
Effect of Investor Classifications (Table 1)



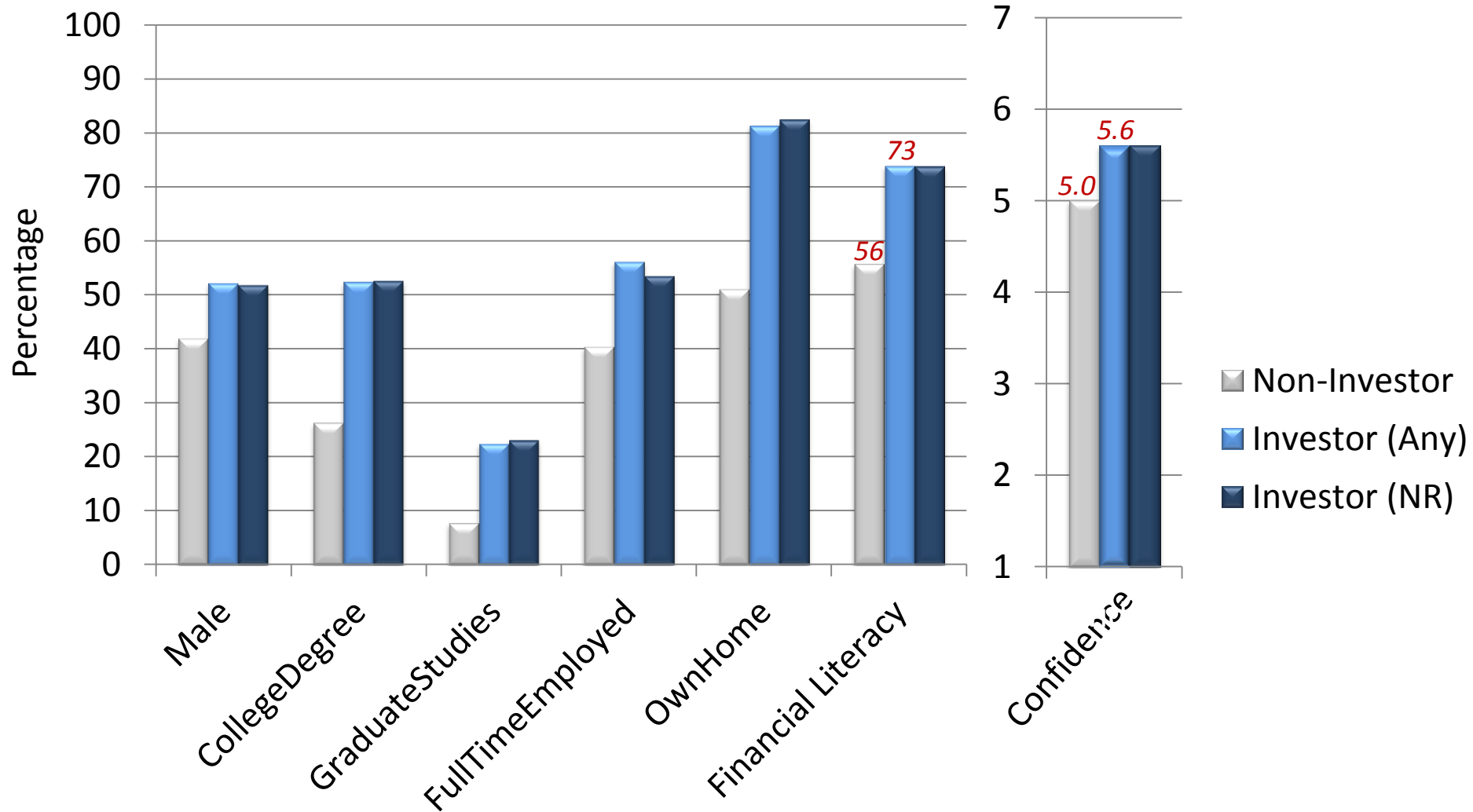
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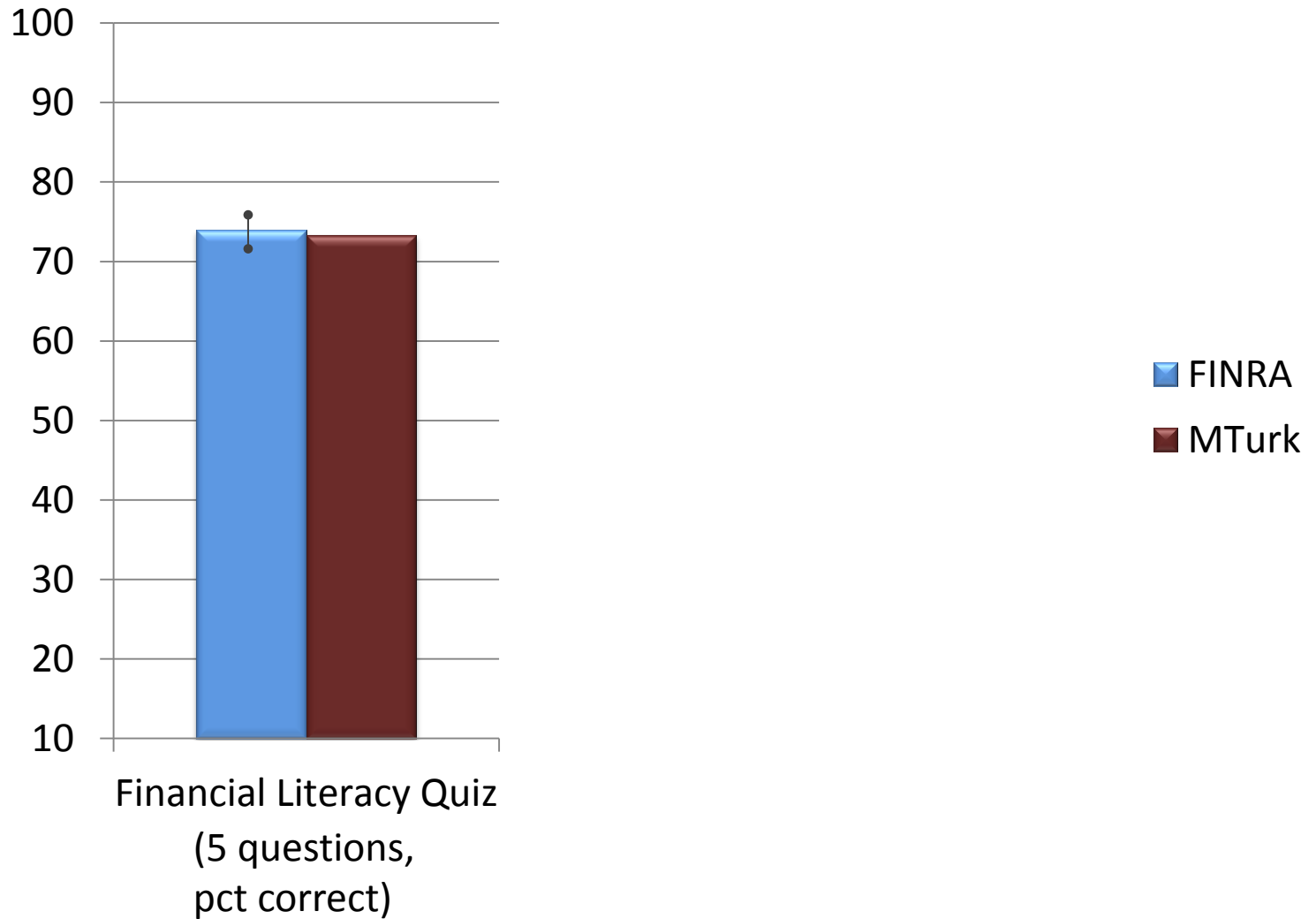
Effect of Investor Classifications (extending Table 1)



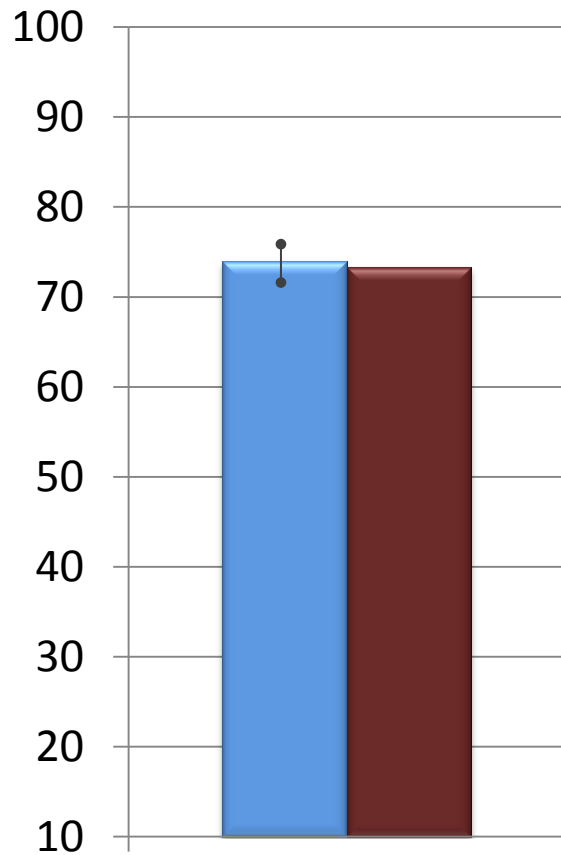
Effect of Investor Classifications (FINRA, untabulated)



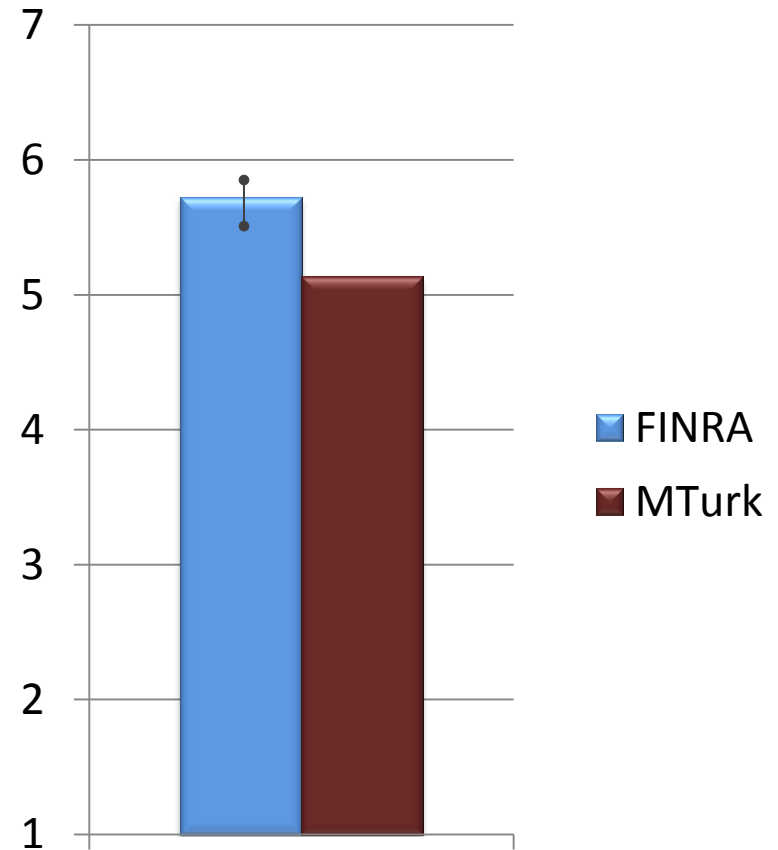
Investors' Financial Confidence and Literacy (Table 1)



Investors' Financial Confidence and Literacy (Table 1)



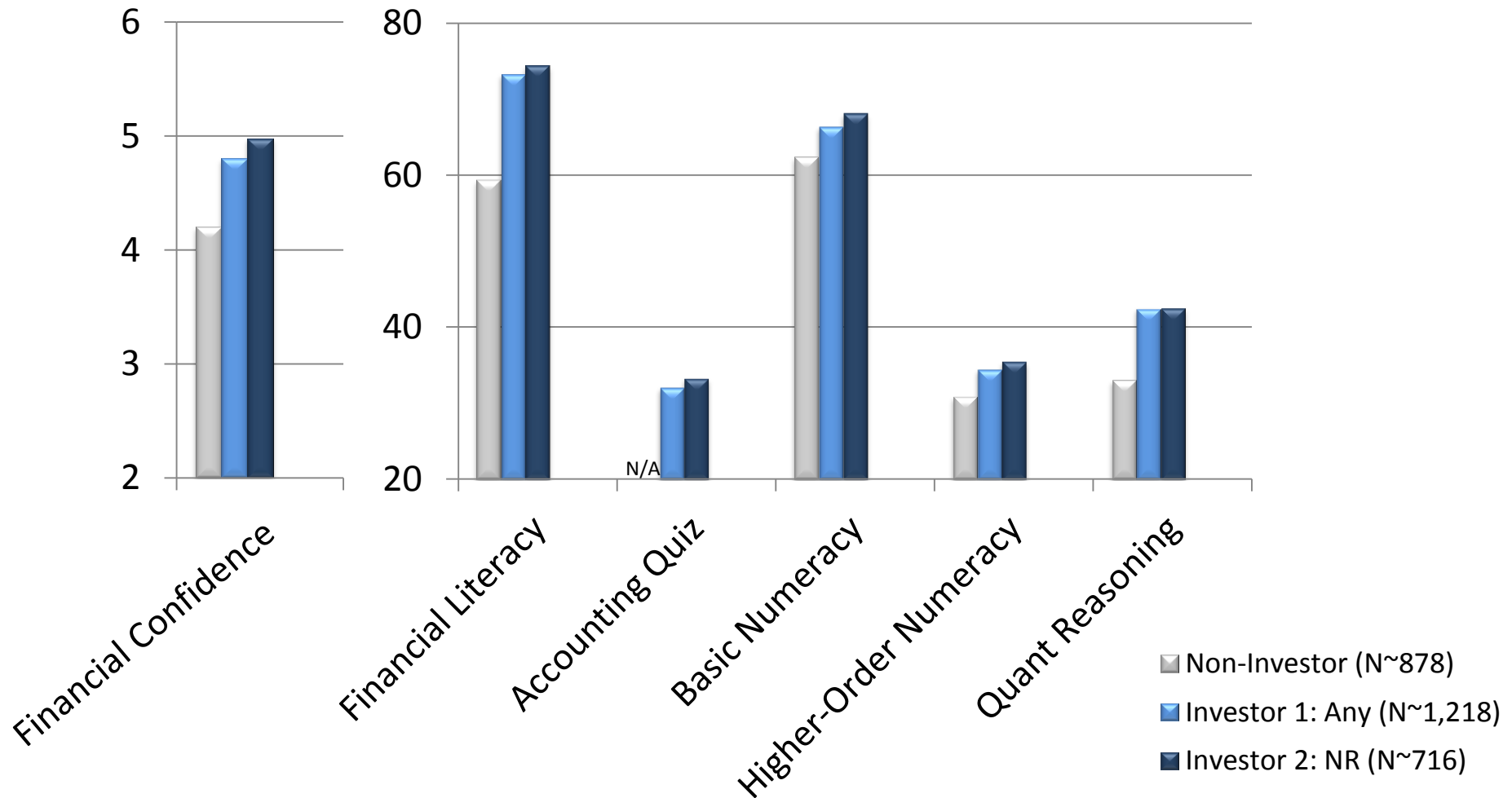
Financial Literacy Quiz
(5 questions,
pct correct)



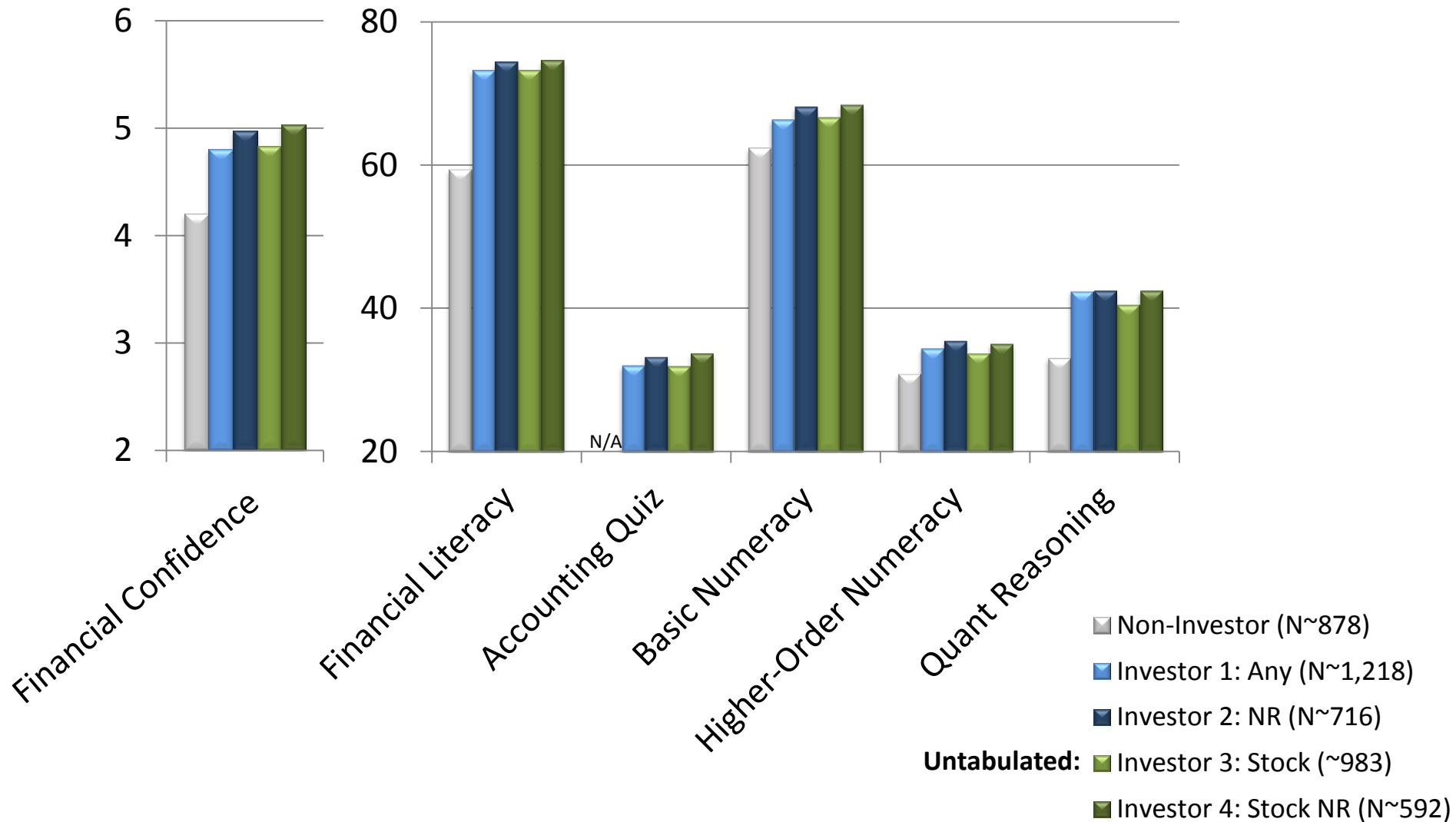
Confidence
(4 questions averaged,
rated from 1 to 7)

■ FINRA
■ MTurk

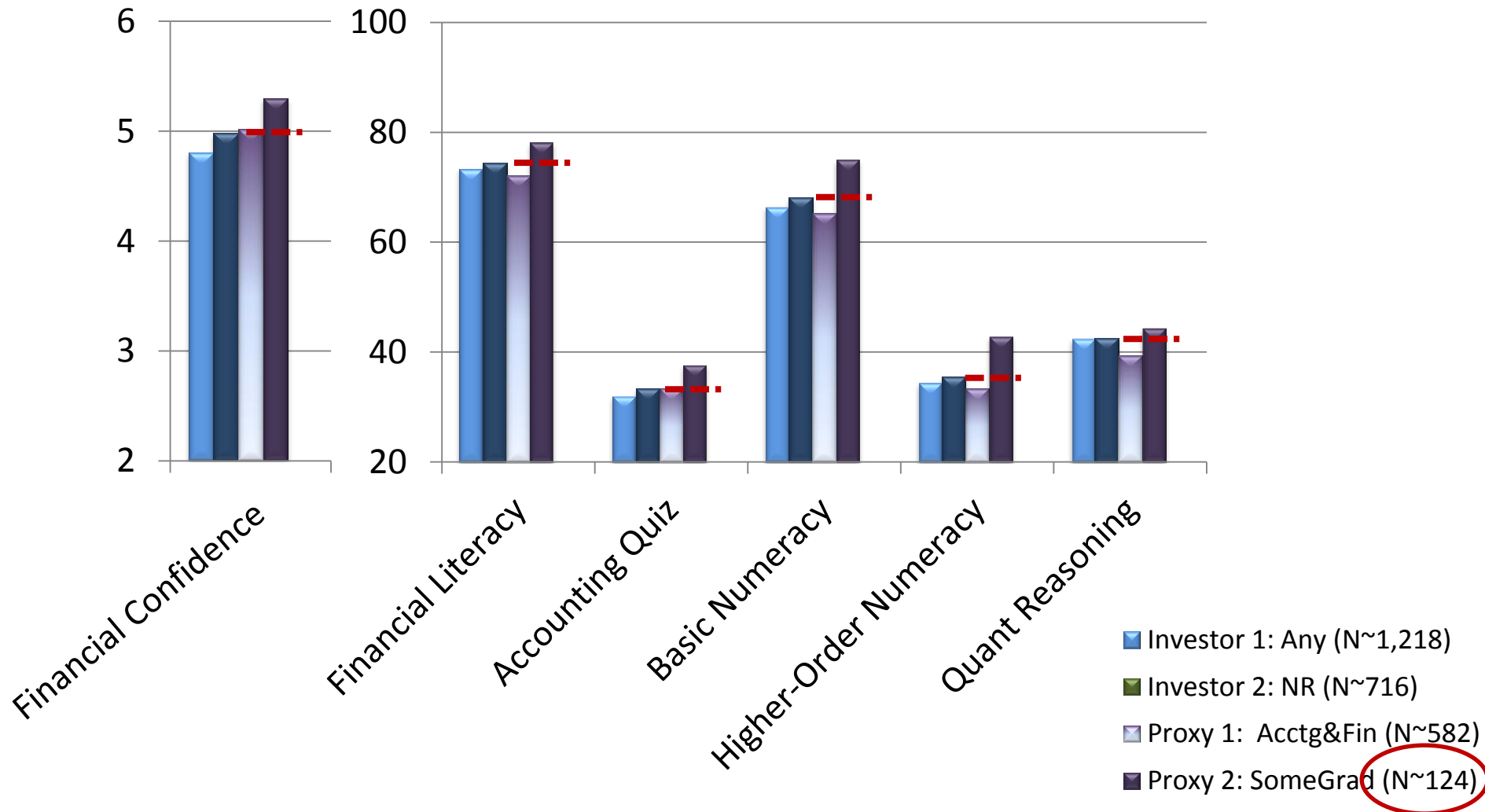
Effect of Investor Classifications on Numerical Skills (Table 2)



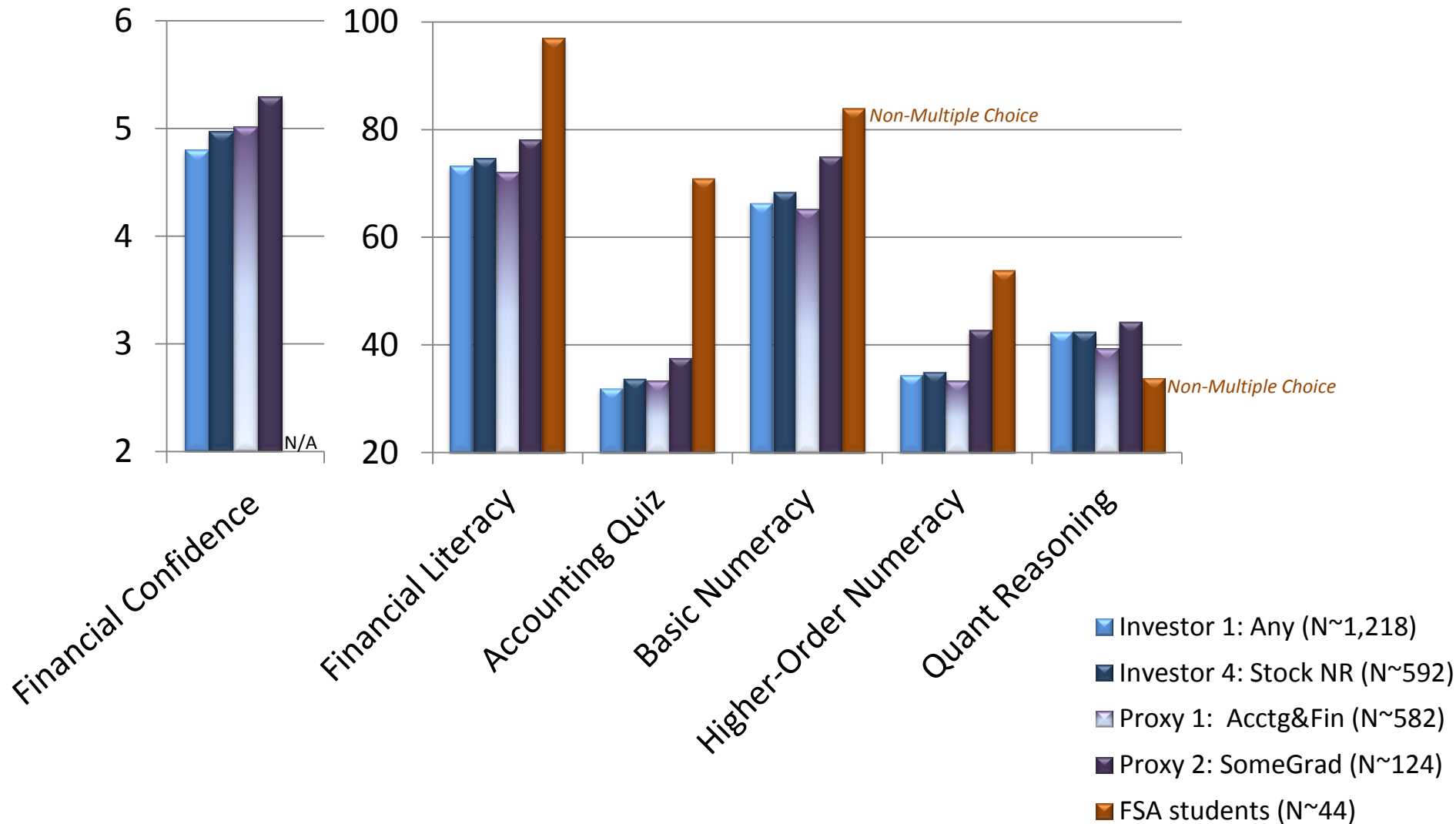
Effect of Investor Classifications on Numerical Skills (extending Table 2)



Effect of Education-Based Proxies on Numerical Skills (Table 3)



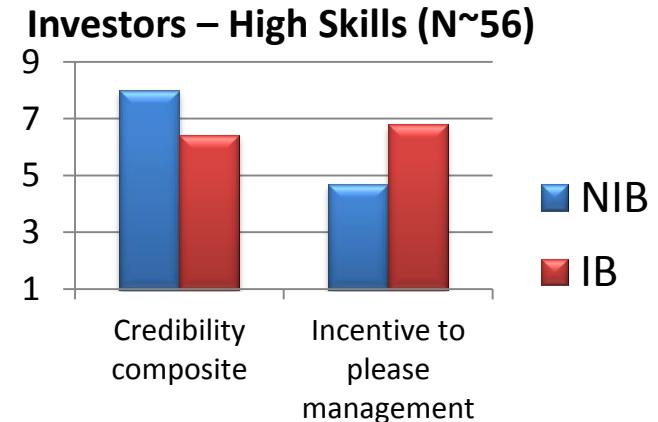
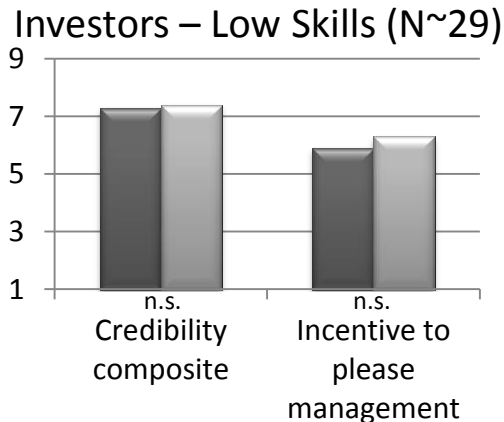
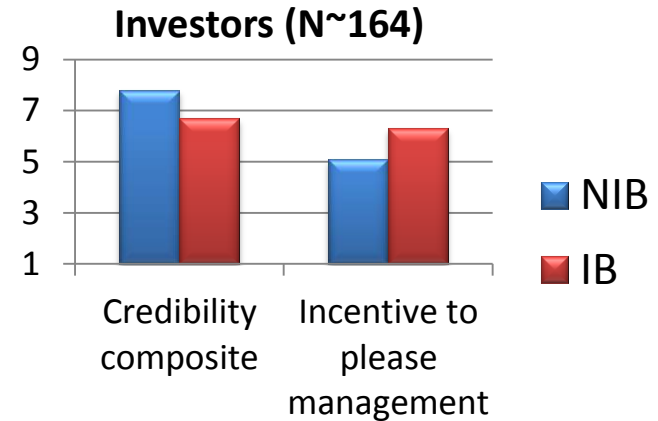
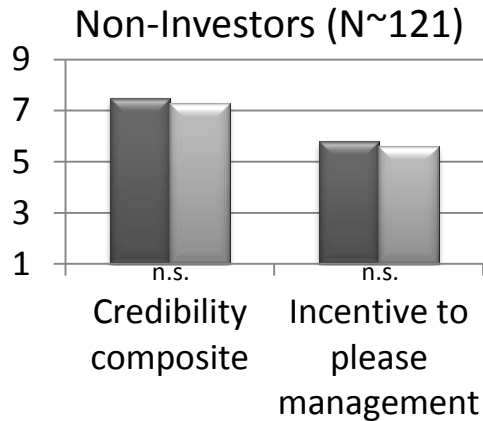
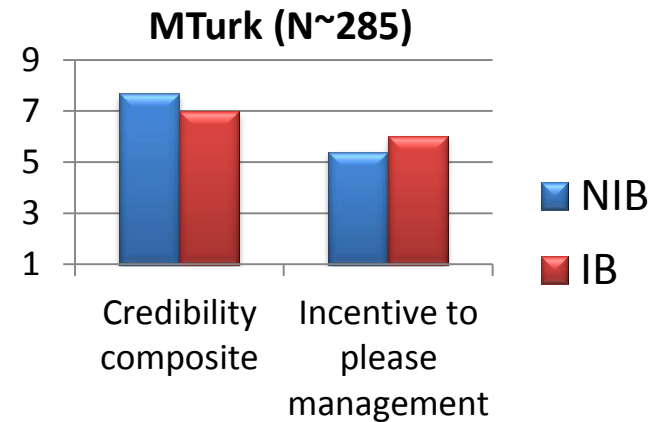
Effect of Education-Based Proxies on Numerical Skills (Table 3)



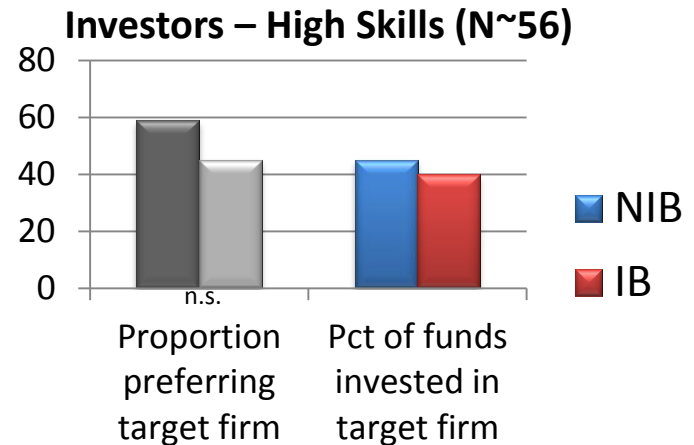
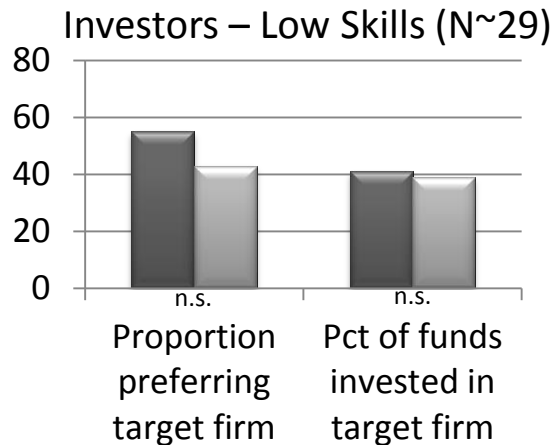
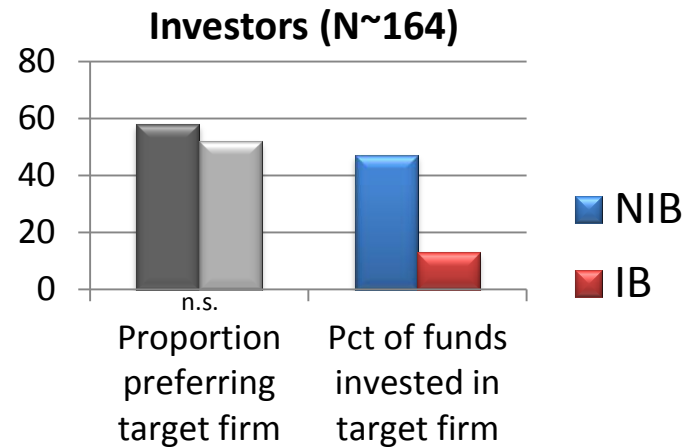
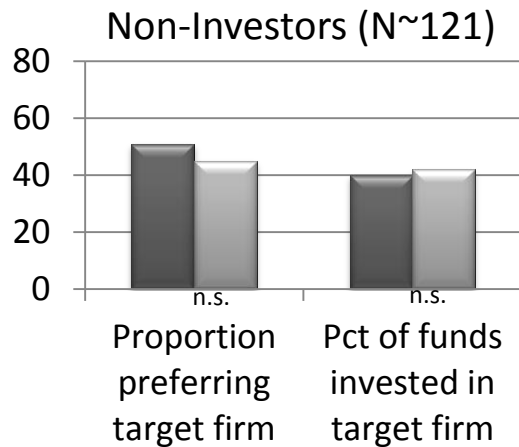
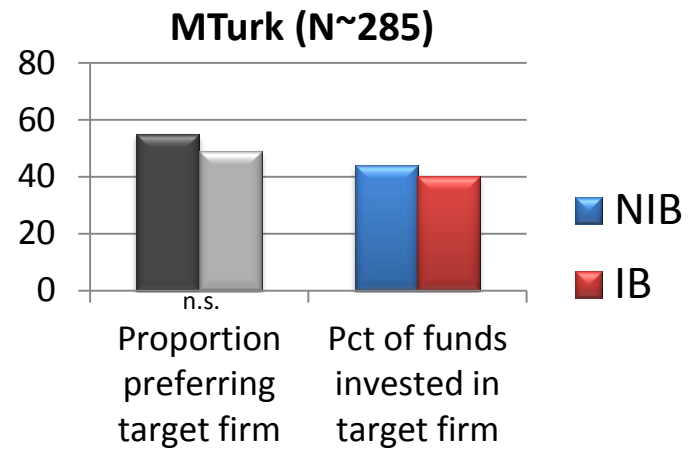
Replication 1

- **Elliott et al.'s (*TAR* 2008) Experiment 1**
- **Participants in the role of an investor assess an analyst report on a firm**
 - Analyst maintains an investment banking relationship (IB) or does not maintain an investment banking relationship (NIB) with the firm
- **Awareness of analysts' incentives and how those could influence their reports.**
- **Relative to NIB, IB...**
 - decreases analyst credibility
 - increases perceived incentives to please management
 - decreases proportion of participants preferring to invest in target firm, and
 - decreases percentage of funds invested in target firm.

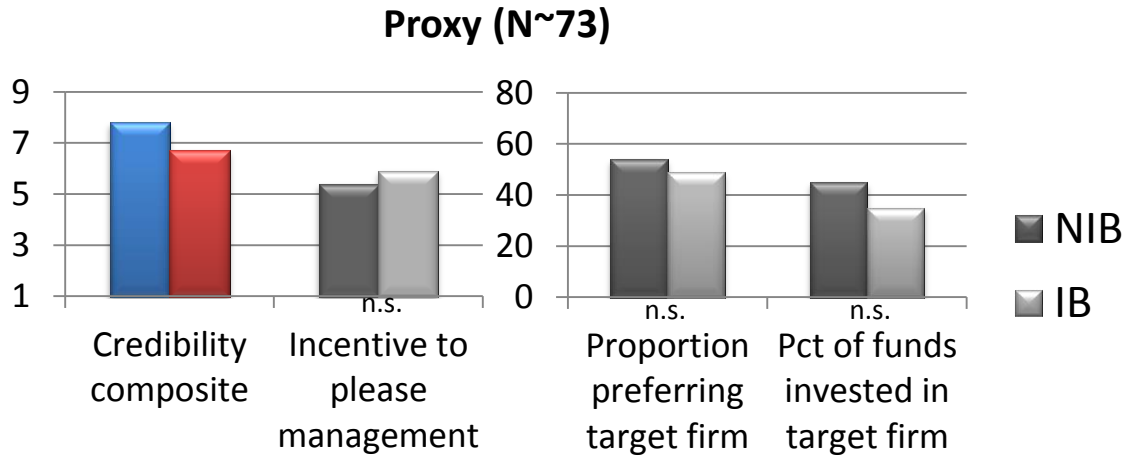
Effect of Investment Experience and Numerical Skills on Replication 1 Judgments (Table 5)



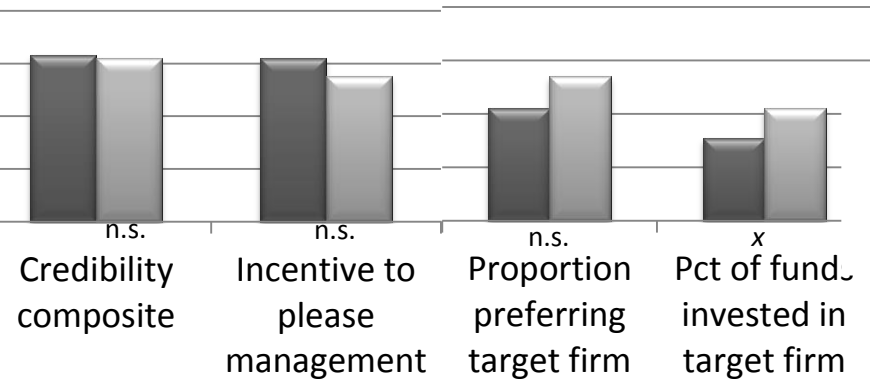
Effect of Investment Experience and Numerical Skills on Replication 1 Investment Choices (Table 5)



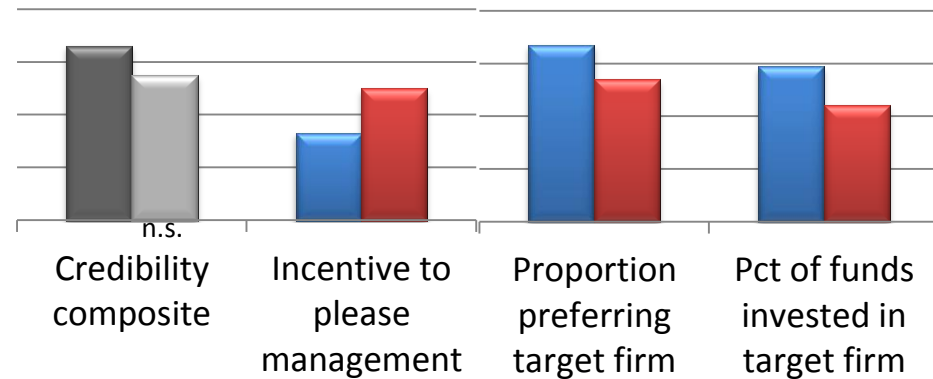
Education-Based Proxy for Investment Experience (Table 5)



Low Skills (N~25)



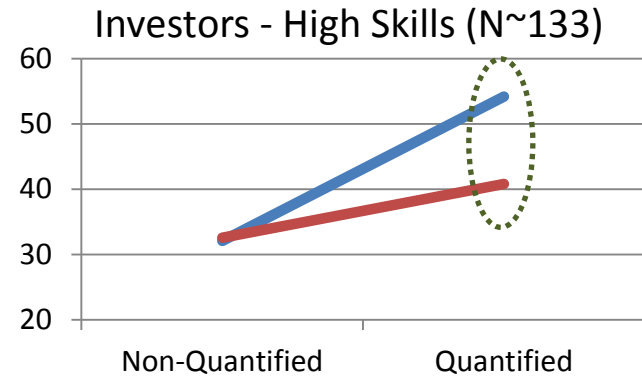
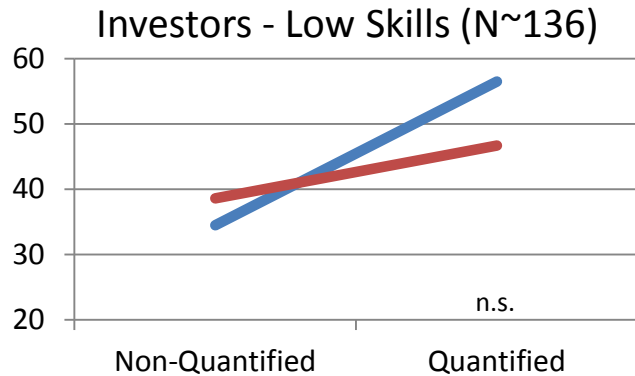
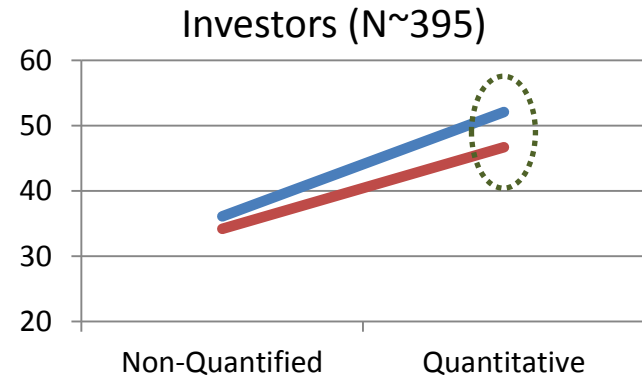
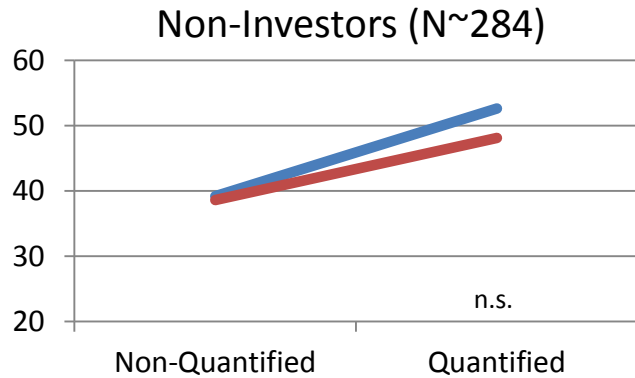
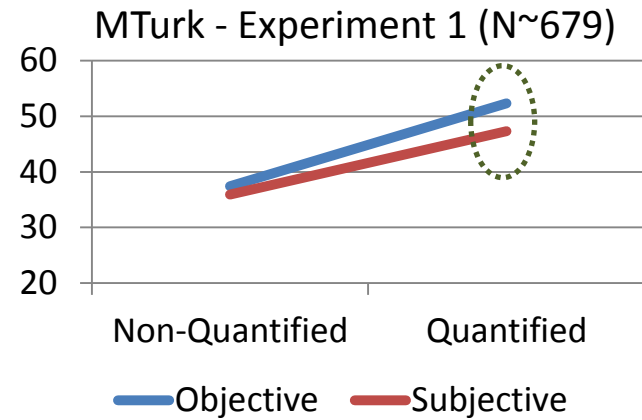
High Skills (N~24)



Replication 2

- **Kadous et al. (CAR 2005) Experiments 1 & 2**
- **Participants as supervising managers receive a proposal to postpone routine but expensive maintenance on machinery for one division:**
 - Presentation of quantitative information (both Experiments)
 - Subjectivity of that information (Experiment 1)
 - Division manager's incentives are consistent or inconsistent with firm's long-run best interests (Experiment 2)
- **Potential persuasion tactics in a business setting (rather than in an individual investor setting *per se*).**
 - Here, MBA students proxy for firm managers
- **Highest perceived likelihood of postponement when proposal is:**
 - Quantified and Objective (Experiment 1)
 - Quantified and Consistent (Experiment 2)

Effect of Investment Experience and Numerical Skills on Replication 2 Experiment 1 (Table 6)

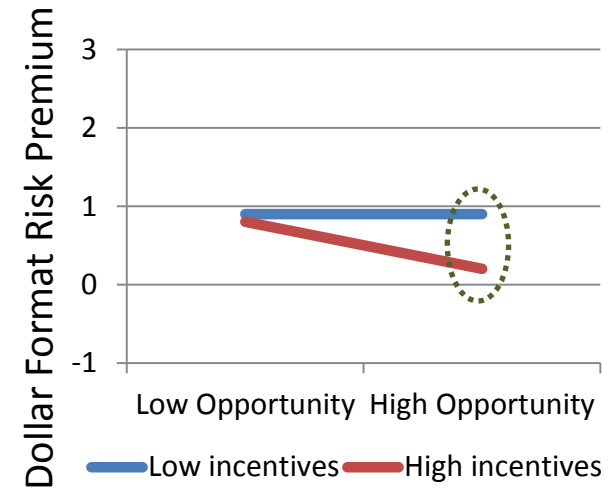
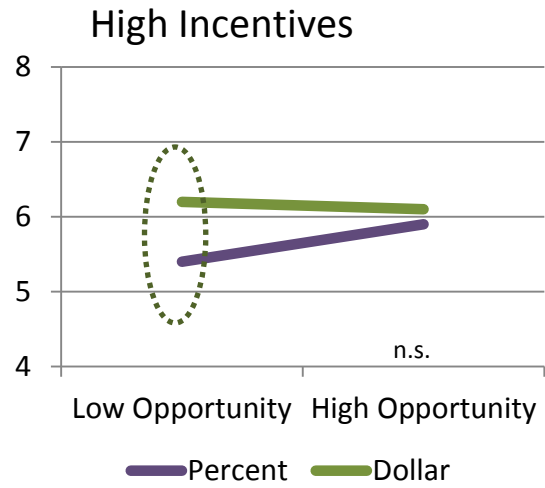
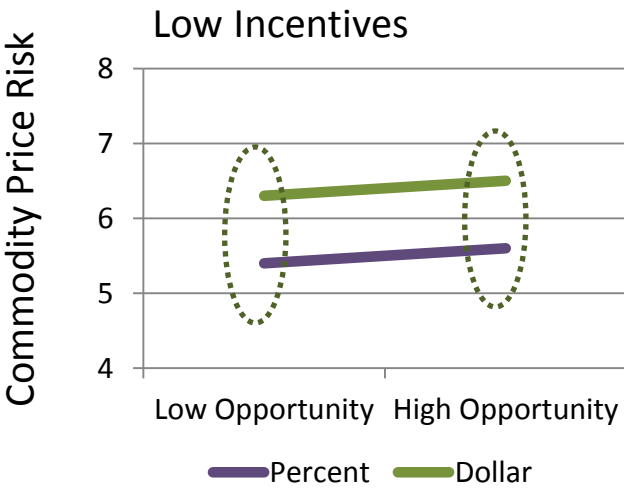


Replication 3

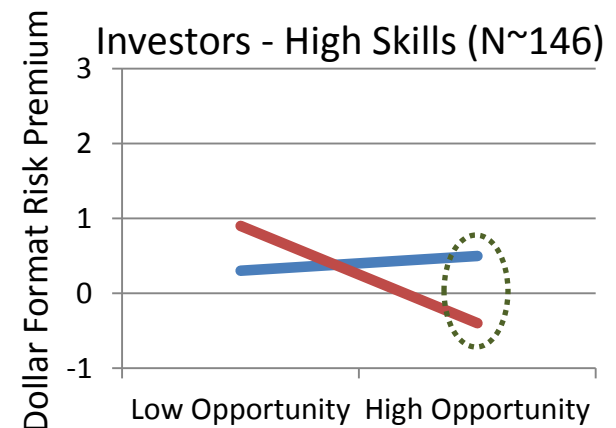
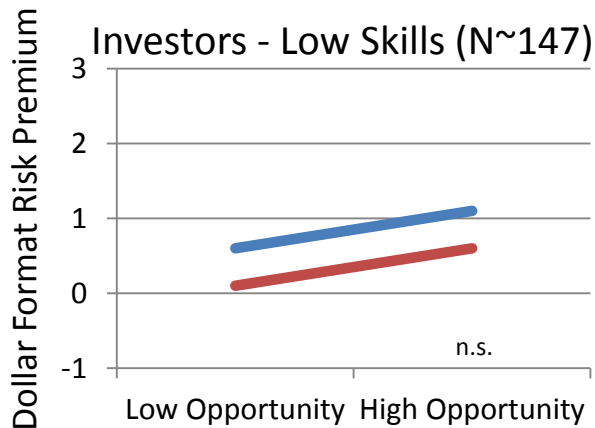
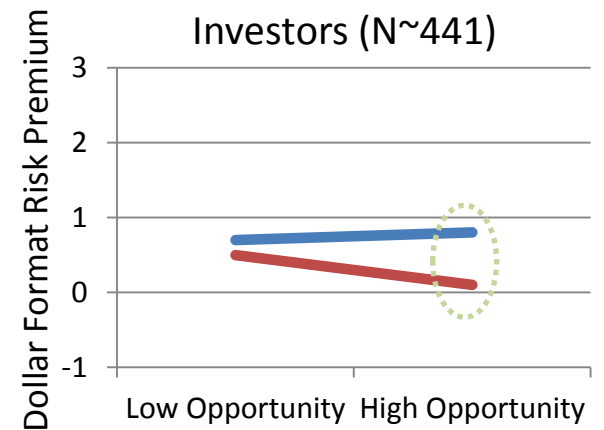
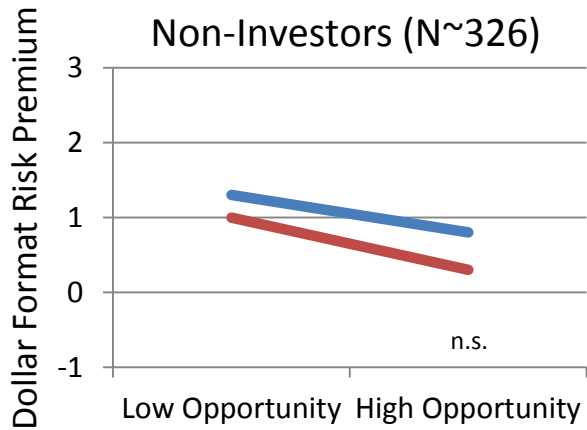
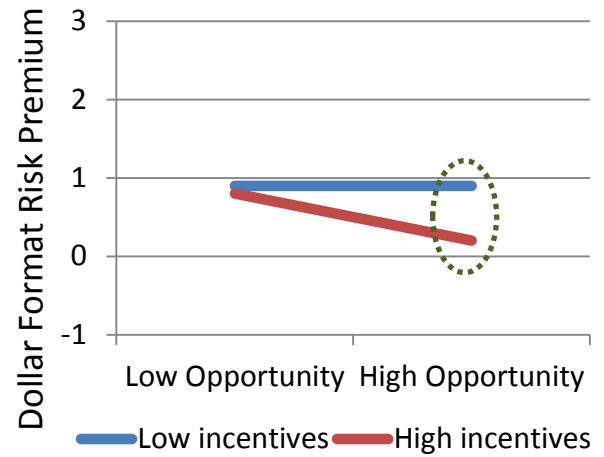
- **Nelson and Rupar (2011 WP) Experiment 1**
- **Participants assess a firm's commodity price risk**
 - Numerical format (dollar vs. percentage)
 - Firm has a choice of format or a mandated format
 - WS: Manager's incentive for preferred reporting result
- **Format main effect (Dollar > Percent), but...**
 - Higher opportunity reduces the effect of format
 - Higher incentives reduces the effect of format more when there is higher opportunity
- **Materials focus on particular financial disclosures.**
 - Understanding potential impact of incentives, but technical knowledge may be more relevant

Picturing a three-way interaction for Replication 3

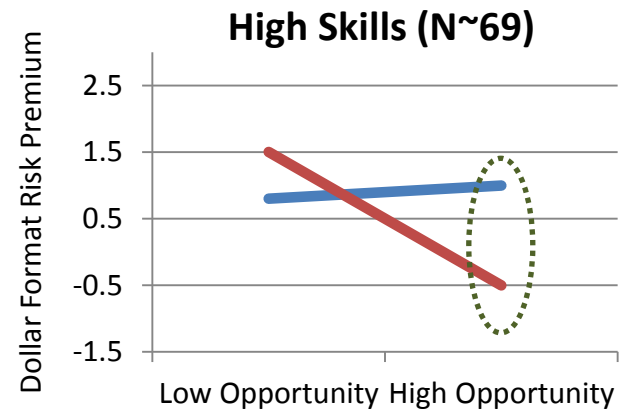
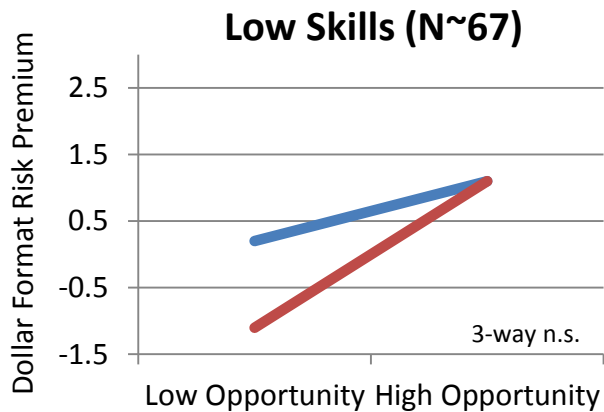
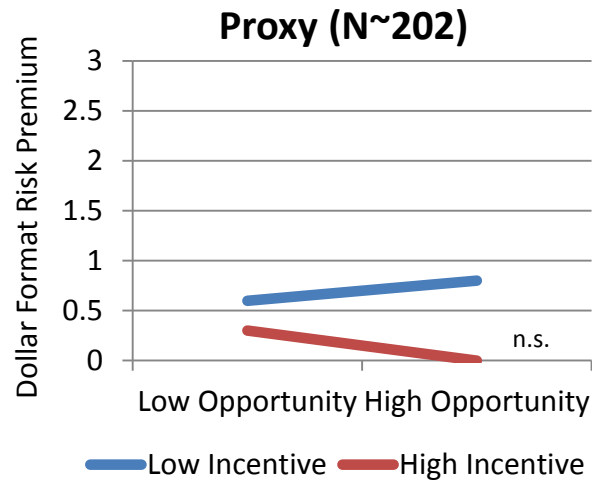
MTurk (N=767)



Effect of Investment Experience and Numerical Skills on Replication 3 (Table 7)



Education-Based Proxy for Investment Experience (Table 7)



Supplemental Analyses

- **Investor classifications correlated but not identical to numerical skills**
 - Probability matching and the conjunction fallacy
- **Investor experience and numerical skills do not always lead to improvements**
 - Employee Stock Option Valuations
- **Level of care and effort as alternative explanation?**
 - Final check question
 - No interaction between investor classification and numerical skills principal component

Summary: Individual Investors

- **Demographics:**
 - More likely to be older, male, employed full-time, educated, and engaged in retirement planning
- **Skills:**
 - More confident but also scoring higher on financial literacy, numeracy, and quantitative reasoning skills.
 - Relatively sophisticated compared to non-investors, but remains relative unsophisticated compared to specialized sample
- **Separating individuals who report**
 - some graduate-level education, and
 - completion of at least one accounting and one finance course

limits generalizability (< 10% of investors)
and tends to result in more extreme skill sets

Investment Experience & Numerical Skills

- **Results of three extant research studies on incentive conflicts of interest**
 - Moderated by investment experience
 - Further moderated by skill sets within investors
- **Accounting research take-aways:**
 - Carefully consider research context and motivation
 - Benchmarking suggests MTurk can provide a viable participant pool
- **Financial literacy research take-aways:**
 - Mixture of causal and correlational findings
 - Financial and numerical skills affect investors' judgments
 - What of non-investors?

Investment Experience & Numerical Skills

- **Future research**

- Investigate more technical or more integrative financial accounting settings
- Identify situational characteristics that allow numerical skills to improve performance in financial settings
 - Both contingent on and independent from investor status
- Consider empirical proxies for archival settings (beyond trade size) to capture individual investors' numerical skills and relative sophistication

Individual Investors' Financial Literacy and Numerical Skills

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