

Naïve Buying Diversification and Narrow Framing by Individual Investors

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May 2022

Overview

- 1 Introduction
- 2 Data
- 3 Naïve Buying Diversification
- 4 Naïve Buying Diversification and Narrow Framing
- 5 Why Do Investors Use the NBD Heuristic?
- 6 NBD and Portfolio Performance
- 7 Naïve Buying Diversification and Simplification
- 8 Conclusion

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Motivation

When faced with financial decisions people often adopt simple rules

- Save a fixed fraction of income
- Choose a mortgage contract to keep payments at target value

⇒ Heuristics may be poor approximations of (quasi-)rational behavior

⇒ Understanding heuristics is important for realistic models of behavior and for policy design

Motivation

A common choice faced by investors is how to allocate investments across multiple stocks

- Portfolio theory determines optimal diversification (Markowitz 1952)
- Evidence shows individual investors deviate substantially by:
 - ▶ (i) Not participating in risky asset markets (Haliassos & Bertaut 1995)
 - ▶ (ii) Under-diversifying when they do participate in risky asset markets (Goetzmann & Kumar 2008)

Motivation

One major explanation is narrow framing

- Tendency to make choices in isolation instead of an integrated decision (Gilovich & Griffin 2010)
- Explains non-participation, under-diversification
 - ▶ Investors fail to appreciate that the stock market does not vary perfectly with other component's of the investor's portfolio, e.g., real estate (Barberis & Huang 2008)
 - ▶ Investors fail to appreciate that each stock is imperfectly correlated with the rest of the portfolio (Barberis et al. 2006)

This Paper

We examine narrow framing in the context of how investors coordinate new purchases with their current holdings within their portfolio

- We might expect that investors make purchases in order to achieve some target level of *holdings*
- Portfolio theory recommends mean-variance optimal holdings
- A simpler target, which performs well in practice, is $1/N$ weights, see DeMiguel, Galappi, & Uppal 2009

This Paper

Our contribution:

- Show that investors commonly group trades on the same day
 - ▶ 31% of total invested in our sample due to multiple-stock buy-days
- Investors commonly split their *buy-day investments* $1/N$
- Use $1/N$ as a buy rule, not as a portfolio balancing rule

⇒ Engage in *Naïve Buying Diversification* not *Naïve Portfolio Diversification*

This Paper

Our contribution:

- Test between competing hypotheses for NBD
 - ▶ *Stock-picking hypothesis*: investor is focused on choice of stocks, does not make an active choice to diversify, and chooses NBD as a simple heuristic
 - ▶ *Diversification motive hypothesis*: investor, who might otherwise have purchase fewer stocks, makes an active choice to diversity by adding stocks
 - ▶ Evidence supports stock-picking hypothesis
- Show that NBD delivers worse portfolio performance than NPD
- Show $1/N$ investors appear to have a preference for simplicity
 - ▶ Choose $1/N$ numerator and denominator to make math simple

Related Literature I

Findings depart from the approach of many behavioural finance models

- In many psychology-based behavioural finance models (non-rational) investors try to optimize an overall portfolio
 - ▶ Examples: Barberis & Huang 2001; Daniel, Hirshleifer, & Subrahmanyam 2001; Grinblatt & Han 2005; Li & Yang 2013; Barberis, Mukherjee, & Wang 2016
- Investors appear to be more concerned with balanced buying *per se*

Related Literature II

Previous literature on the $1/N$ heuristic

- $1/N$ portfolio balancing heuristic
 - ▶ DeMiguel, Galappi, & Uppal 2009
 - ▶ Performs well in practice vs. an optimal portfolio strategy
- Evidence for $1/N$ heuristic
 - ▶ Benartzi & Thaler 2001
 - ▶ Contributions to retirement savings plans
 - ▶ Choice of contribution rate deeply entangles specific purchase transaction rates to overall portfolio weights
 - ▶ Especially given inertia in retirement investing (Madrian & Shea 2001)
- We can distinguish between $1/N$ as a *buying strategy* vs. a *portfolio strategy* because investors make discrete trades

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Data

Barclays Stockbroking individual investor dataset

- Transaction history 182,569 accounts April 2012 – June 2016
- 118,169 make at least one buy transaction during the period
- Nearly all buys are of common stock (6% mutual funds / ETFs)
- Anonymized individual-level identifiers
- Settlement prices for individual trades

Sample

Our focus

- Days on which investors purchase two or more common stocks
- Call these multiple-stock buy-days
- **All accounts:** 261,585 multiple-stock buy-days by 52,866 investors
- **New accounts:** 25,507 multiple-stock buy-days by 8,982 investors
 - ▶ Can reconstruct portfolios on the day (as in Barber & Odean 2001)

⇒ Multiple-stock buy-days account for 31% of total invested in period

Summary Statistics

Table 1: Summary Statistics: All Accounts

Stocks	Mean	Median	75th Pctile
Account Age (months)	49.1	34.9	77.3
Buy-Day Investment	16,500	7,000	15,000
Trades Per Month	1.82	0.74	1.60

Monetary units are British Pounds

Summary Statistics

Table 2: Summary Statistics: New Accounts

Stocks	Mean	Median	75th Pctile
Account Age (months)	11.1	7.8	17.8
Buy-Day Investment	11,500	4,000	10,900
Trades Per Month	1.49	0.66	1.43
Portfolio Value	60,600	17,000	46,400
N Stocks in Portfolio	8.29	5.00	10.00

Monetary units are British Pounds

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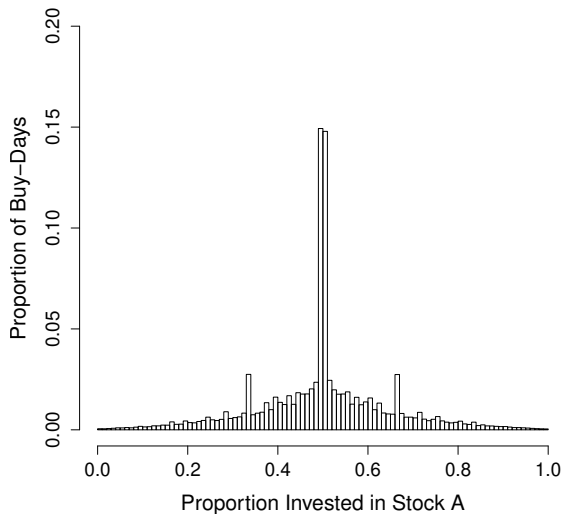
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Diversification on Multiple-Stock Buy-Days

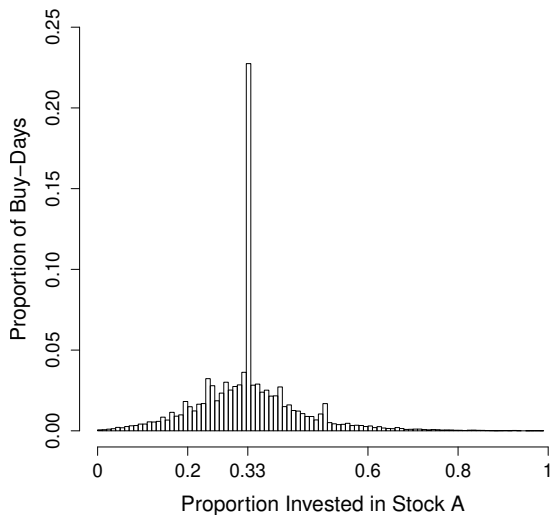
Diversification choices on buy-days

- First, two-stock buy-days
- Choose one stock at random to be “Stock A”
- Calculate proportion of buy-day investment allocated to Stock A
- Repeat for N -stock buy-days
 - ▶ Choice of stock at random avoids possible dependence of observations

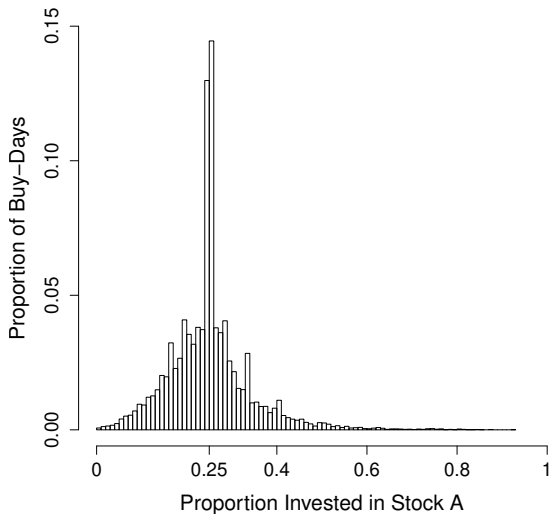
Investment Allocation on Two-Stock Buy-Days



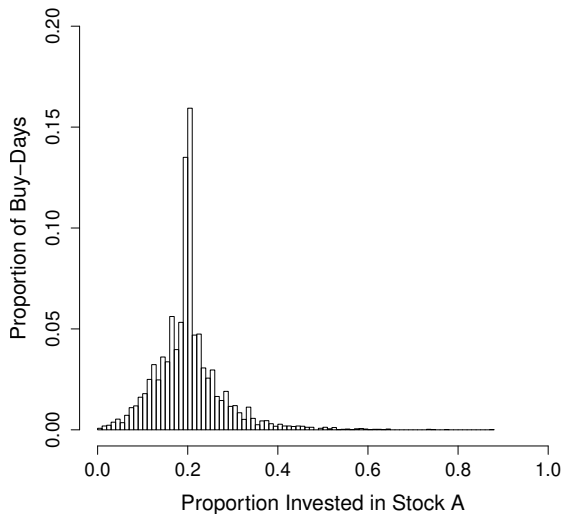
Investment Allocation on Three-Stock Buy-Days



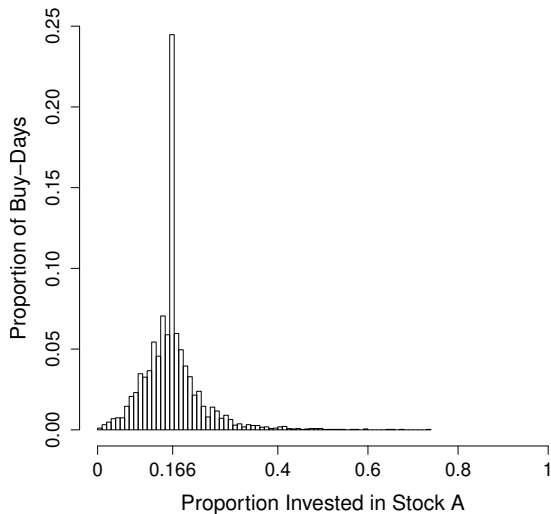
Investment Allocation on Four-Stock Buy-Days



Investment Allocation on Five-Stock Buy-Days



Investment Allocation on Six-Stock Buy-Days



Diversification on Multiple-Stock Buy-Days

Many investors engage in *Naïve Buying Diversification*

- Split investment proportions $1/N$ over N stocks
 - ▶ Mini-peaks, e.g., at 0.33:0.66, 0.66:0.33
- Stock indivisibility implies precise $1/N$ may not be possible
 - 1 For small investment amounts
 - 2 When price of stocks purchased is high
 - ▶ Calculate approximate $1/N$ within bandwidths 49%–51%, 47.25%–52.5%, 45%–55% for two-stock case
 - ▶ For N stock case, generalize to $\frac{P}{N} \times (1 \pm X)$, $X = 0.02, 0.05, 0.10$

Naïve Buying Diversification Summary Statistics

Table 3: Multiple-Stock Buy-Days with $1/N$ Allocations

Stocks	<i>Bandwidth</i>			Obs.
	0.02	0.05	0.1	
2	29.7%	36.5%	45.6%	177193
3	20.3%	23.3%	27.8%	48896
4	18.6%	20.9%	23.9%	17672
5	17.5%	20.1%	22.4%	7925
6+	15.2%	18.0%	20.0%	9899
All	26.3%	31.8%	39.1%	261585

Naïve Buying Diversification

Is NBD driven mechanically or by recommendation?

- E.g., anchoring to default NBD allocation on the investment platform
 - ▶ Or NBD might be encouraged if platform allows grouping of trades
- Not relevant on Barclays Stockbroking platform
 - ▶ Each transaction required a separate multiple-screen journey
 - ▶ Watch at <https://www.youtube.com/watch?v=AsV-pve696M>

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Narrow Framing

How are investors using the $1/N$ rule?

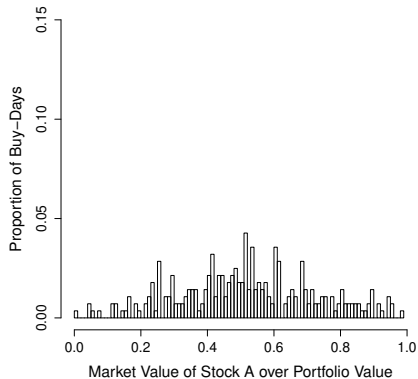
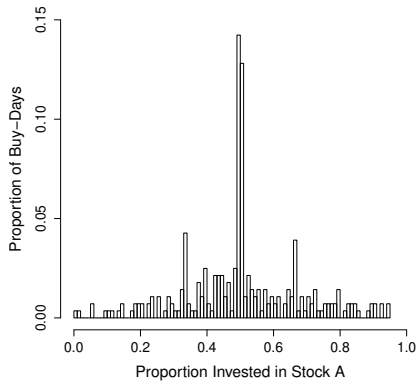
- $1/N$ is a useful *portfolio* heuristic
 - ▶ DeMiguel, Galappi, & Uppal 2009
 - ▶ Easy to implement
 - ▶ Performs well in practice vs. attempting to hold the optimal portfolio due to estimation error
- However, investors appear to be engaging in NBD, not *Naïve Portfolio Diversification* (NPD)
- Explore NBD vs NPD in more detail

Narrow Framing

“Top-up” Buy-days

- Buy-days where investors add to existing positions in multiple stocks
- Do investors buy to achieve NBD or NPD?
- Allow tolerance in definition of NBD and NPD ($X = 0.02, 0.05, 0.10$)
 - ▶ Results are invariant to changes in bandwidth

NBD vs. NPD: Top-Up Buy-Days



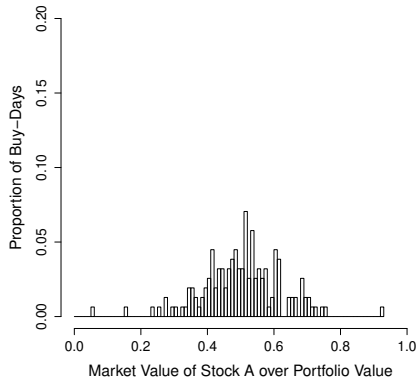
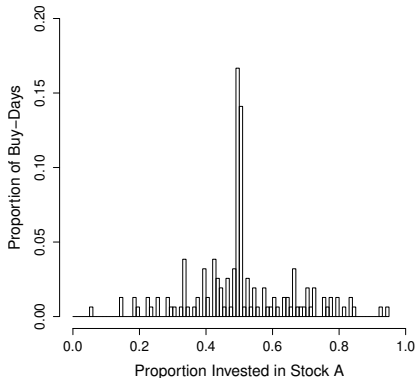
Narrow Framing

Sensitivity test

- Given value of existing positions and size of investment on the day, a $1/N$ portfolio allocation may be unreachable without
 - 1 Increasing total amount invested on the day, or
 - 2 Selling existing position(s)
- These frictions might cause us to *underestimate* NPD
 - ▶ Restrict to sub-sample that requires neither 1 or 2

NDB vs. NPD: Top-Up Buy-Days

- Additionally restricted sample



Narrow Framing

NBD vs NPD on all buy-days (not just top-ups)

- Examine allocation on all buy-days involving multiple stocks
 - 1 With or without existing positions
 - 2 Topping-up positions or buying new stocks
- Investors commonly achieve NBD but hardly ever NPD

NDB vs. NPD: All Buy-Days



Narrow Framing

Summary: Investors aim for NBD, not NPD

- Act very narrowly, naïvely diversifying their buying, not their holdings
- Little evidence of any investors buying such that they achieve NPD
- Investors *appear* to have a buy strategy but not a portfolio strategy

Extension: Selling Behaviour

Narrow framing may be less likely in selling behavior

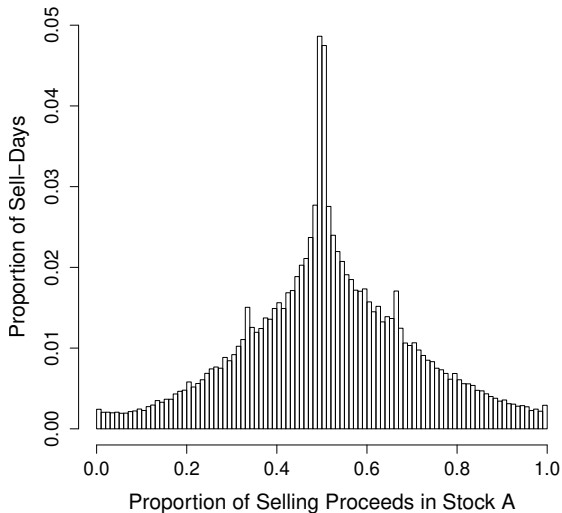
- When selling, investors are confronted with portfolio information
- Disposition and rank effects suggest investors examine portfolios
 - ▶ Barber & Odean 2013, Hartzmark 2015
- *Naïve Selling Diversification* may be less common

Extension: Selling Behaviour

Selling behaviour

- Focus on days on which investors sell multiple-stocks
 - ▶ 15% of sell-days involve multiple-stocks
 - ▶ 62% are liquidation sales
 - ▶ We focus on non-liquidation sales
- Study allocation of sell amounts across N stocks sold on the day
 - ▶ Choose one stock at random to be “Stock A”
 - ▶ Calculate proportion of sell-day amount allocated to Stock A
- Also estimate whether multiple-stock sell-days result in NPD

Naïve Selling Diversification



Naïve Selling Diversification

Naïve Selling Diversification

- Present, but not as common as NBD
 - ▶ Occurs on 13% of two-stock sell-days
 - ▶ Occurs on 11% of all multiple-stock sell-days
- NPD also uncommon on sell-days
 - ▶ Across all multiple-stock sell-days, 7.2% result in NPD
 - ▶ Across all multiple-stock buy-and-sell-days, 2.8% result in NPD

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Explanations for NBD

Examine two main potential explanations

- *Stock-picking hypothesis*: investor is focused on choice of stocks, does not make an active choice to diversify, and chooses NBD as a simple heuristic
- *Diversification motive hypothesis*: investor, who might otherwise have purchase fewer stocks, makes an active choice to diversity by adding stocks

These hypotheses yield testable implications

- Under stock-picking hypothesis, NBD more common when investors buy similar stocks in the preferred (sub)set
- Under diversification hypothesis, NBD more common when investors buy different stocks, as they try to diversify their purchases

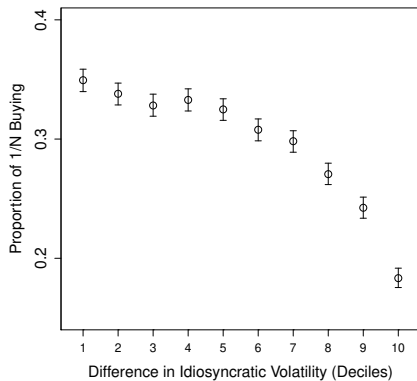
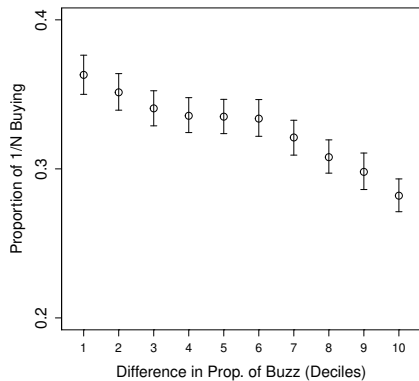
Hypothesis Testing

Use four measures of similarity by calculating differences between stocks in:

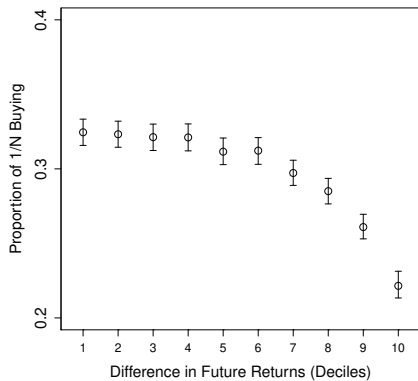
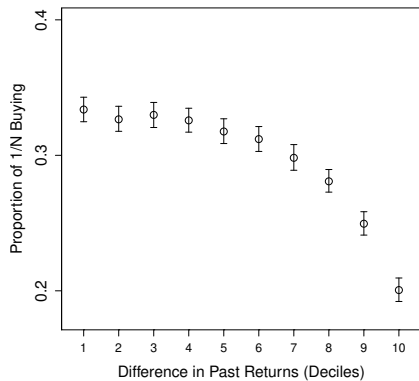
- Idiosyncratic volatility: daily excess returns of ordinary shares listed in the LSE from a single-index model
- Past 60-day returns
- Forward 60-day returns
- News salience: measure of news “buzz” for a stock on a given day calculated by the Thomson Reuters MarketPsych Index (TRMI).
Calculate difference in share of daily buzz accounted for by each stock

NBD is more common when stock similarity is higher, consistent with stock-picking hypothesis

NBD and Stock Similarity I



NBD and Stock Similarity II



NBD and Stock Similarity

Table 4: OLS Regression for NBD Purchase Dummy

	(1)	(2)	(3)
Diff in Past 60-Days Return	-0.0002 (0.003)	-0.058*** (0.013)	-0.093*** (0.022)
Diff in Next 60-Days Return	-0.107*** (0.007)	-0.108*** (0.011)	-0.059 (0.034)
Diff in Idiosyncratic Return (60-days)	-0.034*** (0.003)	-0.110*** (0.011)	-0.076** (0.026)
Diff in Proportion of Buzz (3-Days MA)		-0.381*** (0.036)	-0.456*** (0.085)

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NBD and Portfolio Performance

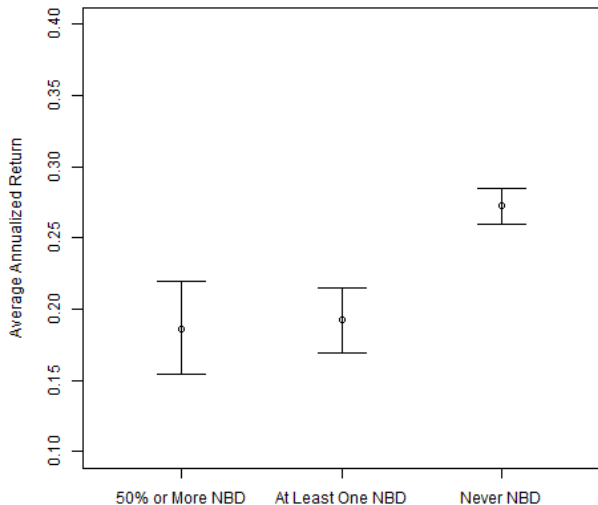
Does NBD damage portfolio performance?

- What is the relevant measure of performance for these investors?
- Seems unlikely that these investors focus on risk-adjusted returns

We therefore address this in two ways:

- Evaluate performance of NBD and non-NBD investors using a simple measure of average unadjusted returns observed across investor types
- Simulate differences in portfolio performance under NBD and NPD strategies, calibrated from the data (following DeMiguel et al., 2009)

Annualized Total Returns for NBD and non-NBD Investors



Simulation Model

Evaluate Sharpe ratios using single-factor model of DeMiguel et al. (2009)

- Key element in the model is idiosyncratic volatility
- With zero idiosyncratic volatility, NBD equates with NPD
- As idiosyncratic volatility increases, NBD and NPD strategies diverge in terms of realised weights on portfolio holdings
- We present “high” and “low” idiosyncratic volatility simulations, calibrated by observed volatility levels in the data

NBD performs worse under higher idiosyncratic risks at longer durations

Sharpe Ratio Simulations NBD vs NPD

Panel A: Low Idiosyncratic Risk

Strategy	$N_i = 5$		$N_i = 10$		$N_i = 20$	
	$T = 120$	$T = 360$	$T = 120$	$T = 360$	$T = 120$	$T = 360$
NPD	0.127	0.128	0.136	0.139	0.134	0.140
NBD	0.125 (0.661)	0.124 (0.111)	0.135 (0.736)	0.135 (0.161)	0.133 (0.791)	0.136 (0.151)

Panel B: High Idiosyncratic Risk

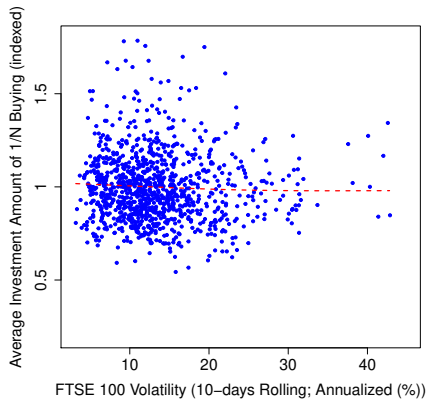
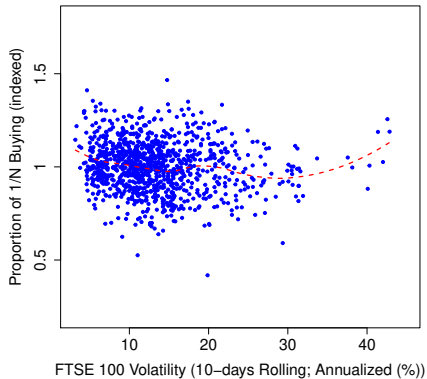
Strategy	$N_i = 5$		$N_i = 10$		$N_i = 20$	
	$T = 120$	$T = 360$	$T = 120$	$T = 360$	$T = 120$	$T = 360$
NPD	0.091	0.091	0.109	0.107	0.126	0.119
NBD	0.081 (0.015)	0.079 (0.000)	0.097 (0.004)	0.084 (0.000)	0.116 (0.014)	0.092 (0.000)

Simulation Model

Key question, therefore, is does use of NBD reduce when idiosyncratic volatility is high?

- Investors might moderate their use of NBD to mitigate this risk
- We examine $1/N$ trading patterns against FTSE-100 volatility

NBD and Market Volatility



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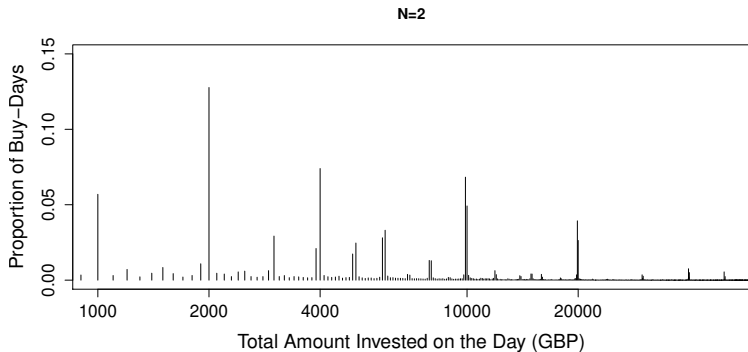
Naïve Diversification and Simplification

Does NBD occur due to preference for simplicity?

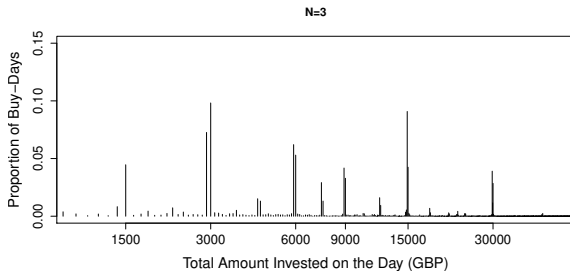
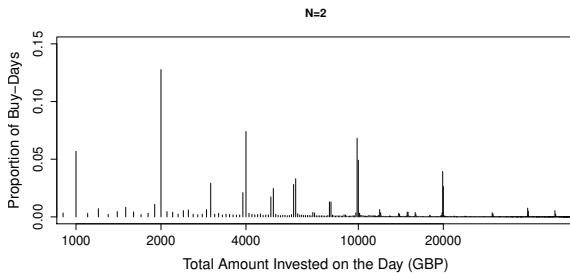
- Investors appear to be simplicity seeking by how they implement $1/N$
 - ▶ Choice of denominator and numerator when using the $1/N$ heuristic
 - ▶ Investors choose so that $1/N$ is reduced to a simple division problem

Simplification of $1/N$

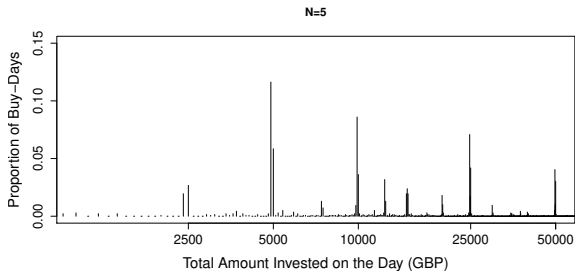
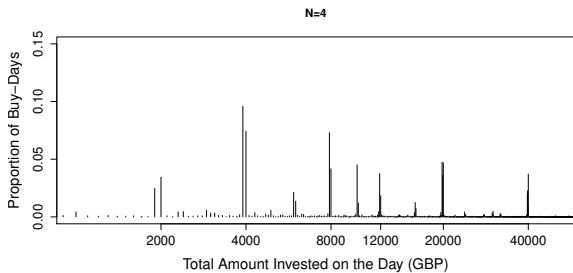
- Distribution of total invested on the buy-day when $N = 2$



Simplification of $1/N$



Simplification of $1/N$

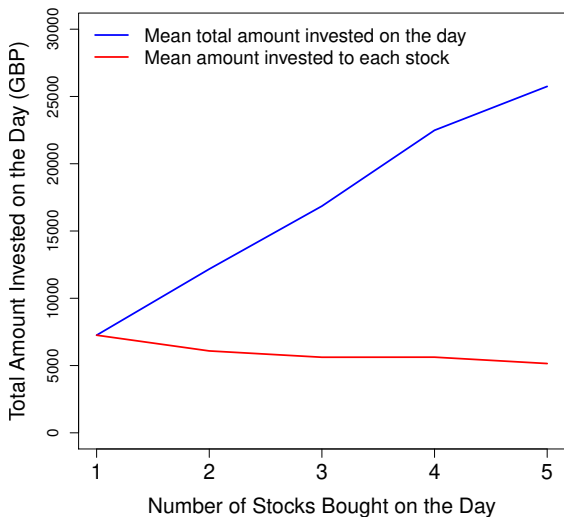


Naïve Diversification and Simplification

Results indicate investors simplify their $1/N$ choices

- Investors act as if jointly determining “1” and N
 - ▶ £2,000 investments associated with $N = 2$
 - ▶ £3,000 investments associated with $N = 3$
 - ▶ £4,000 investments associated with $N = 2$
- Caveat: we do not have exogenous source of variation in denominator or numerator of the calculation

Simplification of $1/N$



Naïve Diversification and Simplification

Do investors buy in fixed amounts per trade?

- On aggregate, mean investment per stock constant with N
- NBD could arise if investors always buy in fixed amounts per trade
- Can reject this hypothesis:
 - ▶ Sample of investors who make at least $1\times$ single-stock buy trade and $1\times$ multiple-stock buy trade within period
 - ▶ Only 2.3% spend the same amount per trade (10% bandwidth)

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Conclusion

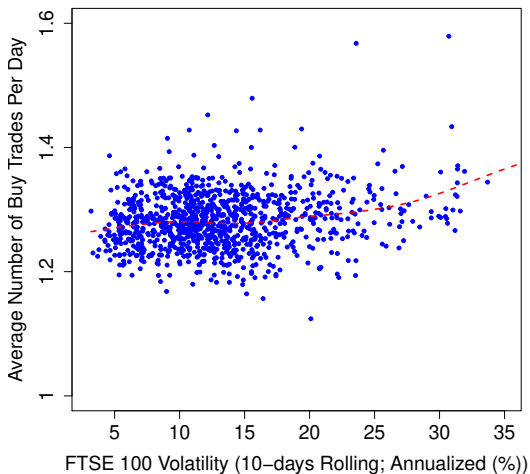
- Investors often use a Naïve Buying Diversification heuristic
- NBD decreases as financial stakes and investor experience increase
 - ▶ Consistent with learning and limited attention
- Investors engage in NBD, not Naïve Portfolio Diversification
- Investors appear to have a preference for simplicity
 - ▶ Choose numerator and denominator to make math simple

Conclusion

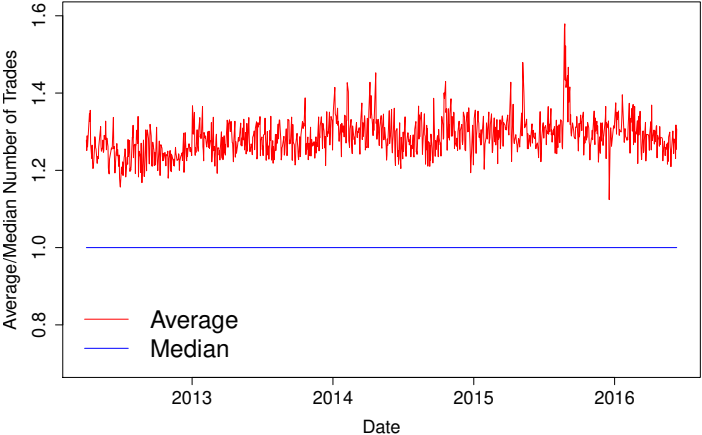
- Investors act surprisingly narrowly in the diversification choices of the stocks they buy
 - ▶ Our results give a suggestive hint that investors do not have a portfolio strategy in mind
 - ▶ While a $1/N$ portfolio strategy can be rationalized in practice, it appears to be very difficult to rationalize a $1/N$ buying strategy
- Existing studies in behavioral finance do not capture this narrow framing behavior

Additional Slides

Number of Stocks Bought and Market Volatility

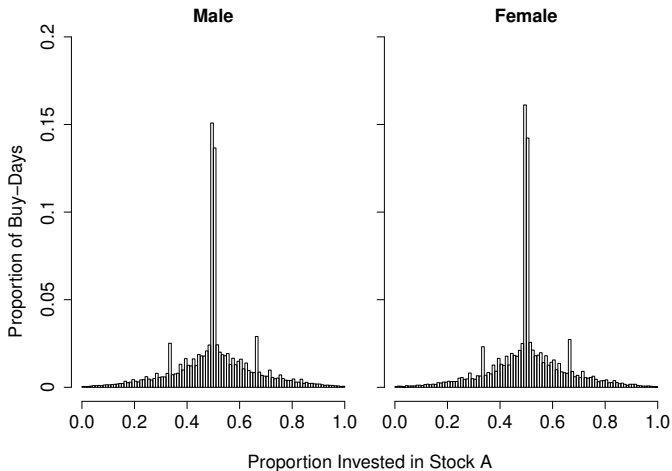


Number of Stocks Bought Time Series



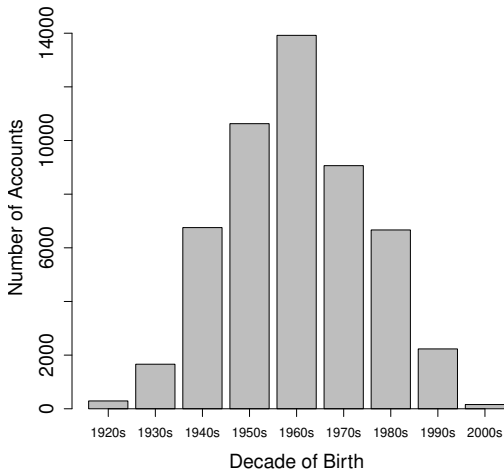
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Investor Types: Gender

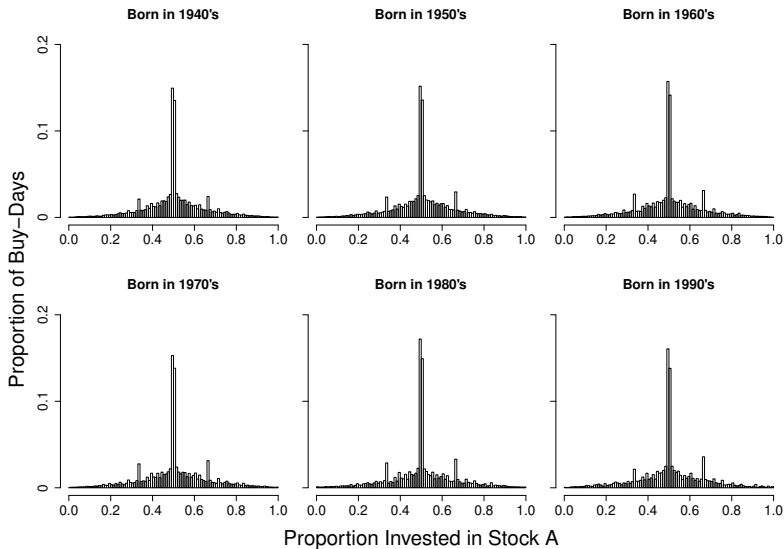


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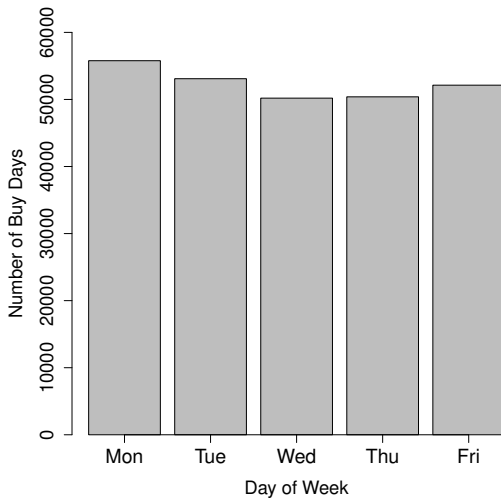
Investor Types: Decade of Birth



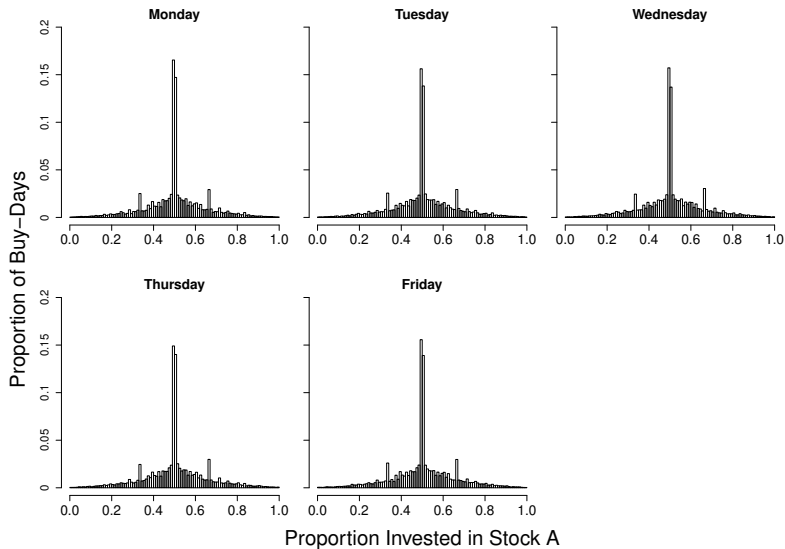
Investor Types: Decade of Birth



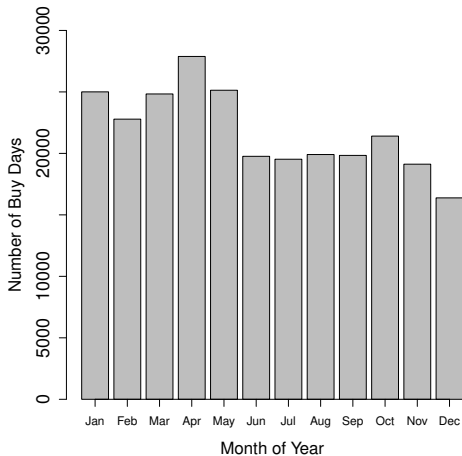
Aside: Day of the Week



Aside: Day of the Week

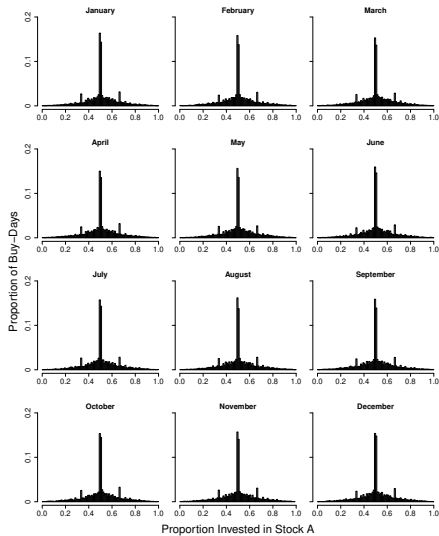


Aside: Month of the Year

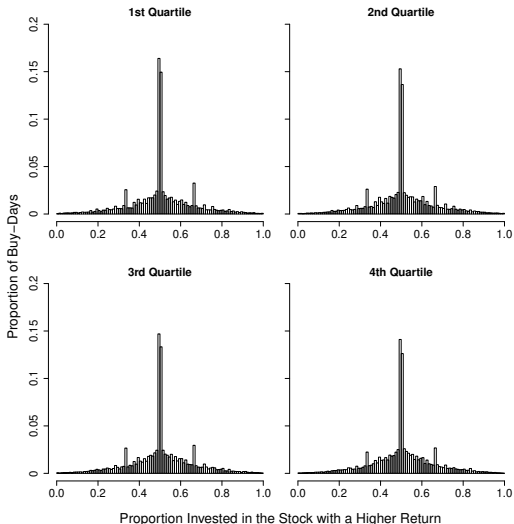


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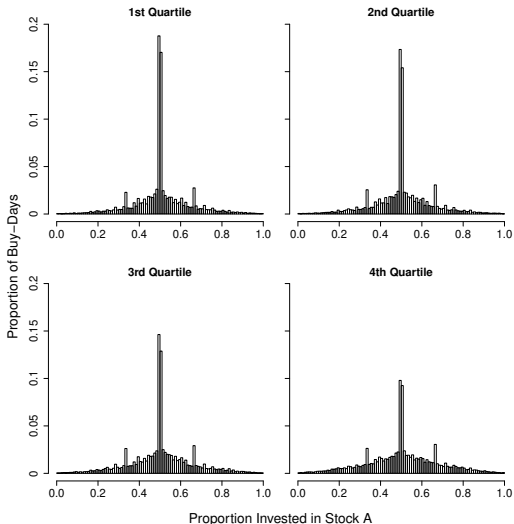
Aside: Month of the Year



Learning: Account Age

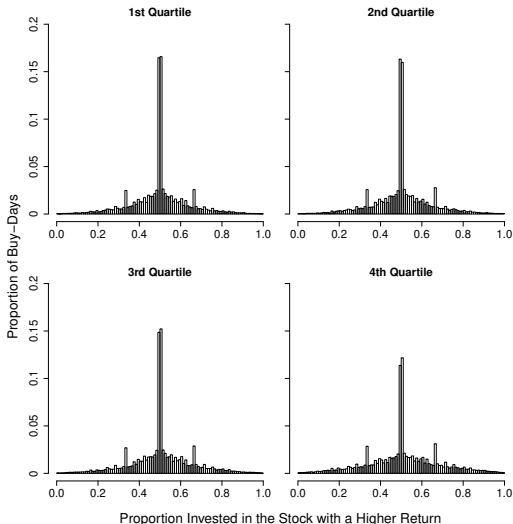


Learning: Trading Frequency

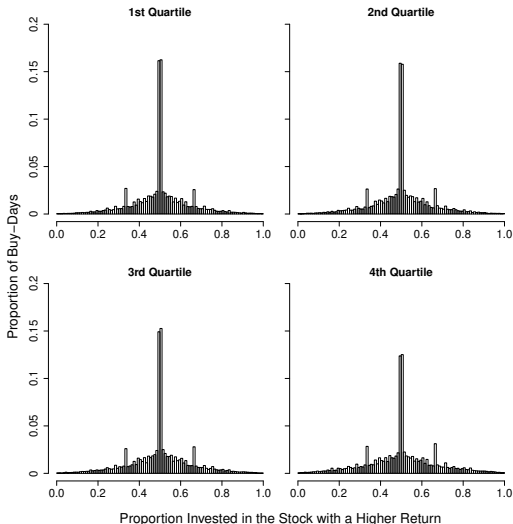


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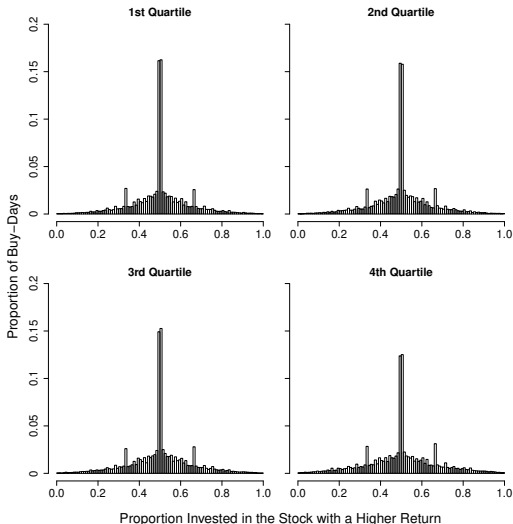
Limited Attention: Difference in Past Returns



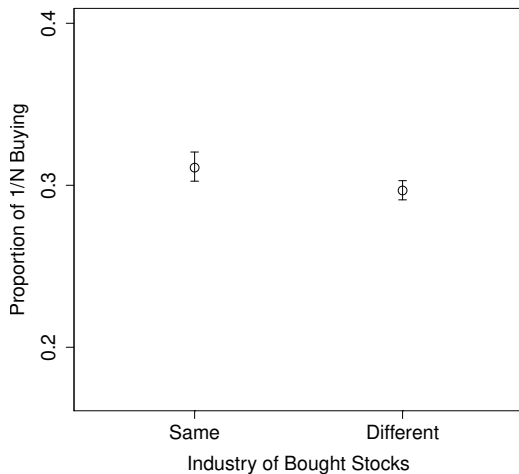
Limited Attention: Difference in Future Returns



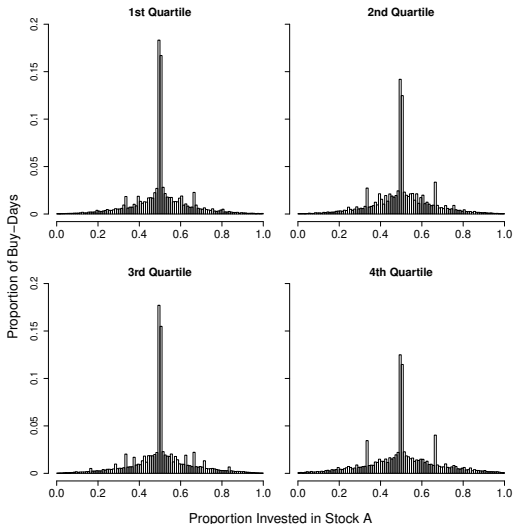
Limited Attention: Difference in Future Returns



Limited Attention: Same vs Different Industry



Limited Attention: Investment Amount



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