

# DIVERSIFICATION IN LOTTERY-LIKE FEATURES AND PORTFOLIO PRICING DISCOUNTS

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October, 2017

# MOTIVATION

- ▶ Efficient-Market Hypothesis: The price of a security is equal to its fundamental value.
- ▶ However...
  - ▶ Closed-end fund discounts
  - ▶ Negative mergers and acquisitions returns
  - ▶ Conglomerate discounts
- ▶ Puzzling Fact: A portfolio may be valued less than the sum of its underlying components.

# BARBERIS AND HUANG (2008)

- ▶ Key assumptions:
  - ▶ Cumulative prospect theory (Tversky and Kahneman, 1992)
  - ▶ Biased probability weighting function
- ▶ Implication:
  - ▶ Investors value a small probability of extremely positive payoffs
  - ▶ Lottery-like (positively skewed) stocks can become overpriced relative to the prediction from the traditional expected utility model

# DIVERSIFICATION IN LOTTERY-LIKE FEATURES

- ▶ A portfolio with lottery-like holdings:
  - ▶ Lottery-like holdings do not simultaneously hit jackpots
  - ▶ The portfolio tend to have a smooth return distribution
- ▶ Based on Barberis and Huang's model:
  - ▶ Lottery-like holdings are traded at a price premium
  - ▶ The portfolio is not traded at a price premium
- ▶ The portfolio is traded at a discount!

# A SIMPLIFIED EXAMPLE

- ▶ Lottery-like stocks A and B have the following payoff per share:

$$R_i = \begin{cases} 100 & \text{prob} = 1\%, \\ 0 & \text{prob} = 99\%. \end{cases} \quad (1)$$

- ▶ A portfolio:  $0.5 \times A + 0.5 \times B$
- ▶ Two extreme cases:
  - ▶ A and B **always** hit "jackpot" together
  - ▶ A and B **never** hit "jackpot" together
- ▶ Compare  $PRC_p$  and  $0.5 \times PRC_a + 0.5 \times PRC_b$

# EMPIRICAL DESIGN

- ▶ "Portfolio": Closed-end fund, acquirer+target, conglomerate
- ▶ Lottery-like feature: Max (Bali, Cakici, and Whitelaw, 2011)
  - ▶ Clear lottery-like feature: "jackpot"
  - ▶ Captures the low probability and extreme return states that drive the results in the model of Barberis and Huang (2008)
- ▶ Hitting "jackpots" together CoMax
  - ▶ How often two stocks hit Max at the same time
  - ▶ Case (1):  $\text{CoMax}=1$
  - ▶ Case (2):  $\text{CoMax}=0$

# MAIN FINDINGS

- ▶ **Finding 1:** Portfolios indeed have lower lottery-like features compared to their holdings.
- ▶ **Finding 2:** The difference between the lottery-likeness of a portfolio and that of its holdings predicts the portfolio pricing discount.
- ▶ **Finding 3:** High tendency of hitting "jaccots" together (high CoMax) mitigates the portfolio pricing discount.

# CONTRIBUTION

- ▶ Interaction Effect:  $\text{Max} \times \text{CoMax}$
- ▶ Support Barberis and Huang (2008) from a new perspective
  - ▶ Separately evaluate the value of the aggregate portfolio and the values of the underlying components
  - ▶ Isolate effects from fundamentals
- ▶ Provide a unifying framework for a set of seemingly unrelated asset pricing phenomena
  - ▶ Closed-end fund discounts
  - ▶ M&A announcement returns
  - ▶ Diversification discounts



# RELATED LITERATURE

- ▶ Empirical studies testing Barberis and Huang (2008)
  - ▶ Boyer, Mitton, and Vorkink(2010), Bali, Cakici, and Whitelaw(2011), Conrad, Dittmar, and Ghysels(2013), Amaya, Christoffersen, Jacobs, and Vasquez(2015), Barberis, Mukherjee, and Wang(2016)
- ▶ Barberis and Huang (2008)'s framework can provide a unifying way to understand
  - ▶ The long-term underperformance of an initial public offering stock (Green and Hwang, 2012); the low average return of distressed stocks (Campbell, Hilscher, and Szilagyi, 2008), of out-of-the-money options (Boyer and Vorkink, 2014), of stocks traded over the counter (Eraker and Ready, 2015); and the lack of diversification in household portfolios (Mitton and Vorkink, 2007; Goetzmann and Kumar, 2008);

# THE PUZZLE

- ▶ Closed-end funds...
  - ▶ A type of mutual fund
  - ▶ Publicly traded
  - ▶ Typically invest in other publicly traded securities
  - ▶ Different from an open-end fund:
    - ▶ Fixed number of shares
    - ▶ Investors must sell their shares to other investors rather than redeem them with the fund itself for the net asset value (NAV) per share.
- ▶ The closed-end fund puzzle:
  - ▶ Closed-end fund shares typically sell at prices lower than the per share market value of assets the fund holds
  - ▶ Time-varying discount

# CEF: AN EXAMPLE

BLACKROCK®

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EQUITY

[Fact Sheet](#)
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BDJ

## Enhanced Equity Dividend Trust

NAV as of 27-Jun-2017

**\$9.45**

1 Day NAV Change as of 27-Jun-2017

▼ -0.01 (-0.11%)

Morningstar Rating

★★★★★

12 MK: 9.35 - 9.54

Market Price as of 27-Jun-2017

**\$8.79**

1 Day Price Change as of 27-Jun-2017

▲ 0.01 (0.11%)

Distribution Rate as of 27-Jun-2017

6.38%

Premium/Discount as of 27-Jun-2017

**-6.98%**

### Holdings

[Top](#)

as of 31-May-2017

Name	Weight (%)	Name	Weight (%)
JPMORGAN CHASE & CO	3.90	ORACLE CORPORATION	2.86
CITIGROUP INC	3.59	WELLS FARGO & COMPANY	2.52
BANK OF AMERICA CORP	3.56	GENERAL ELECTRIC CO	2.32
PFIZER INC	3.44	ANTHEM INC	2.29
DOW CHEMICAL COMPANY (THE)	2.87	MERCK & CO INC	2.24

# SETTING 1: CLOSED-END FUNDS

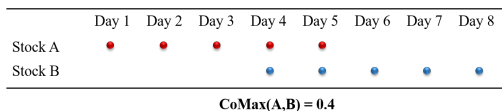
- ▶ Closed-end fund sample
  - ▶ Available monthly CEF prices from CRSP, available net asset value (NAV) from COMPUSTAT
  - ▶ CEF holding data available from Morningstar
  - ▶ US equity closed-end funds, with share code = 14 or 44
  - ▶ Exclude data within the first six months after IPO and one month preceding the announcement of liquidation or open-ending (Chan, Jain, and Xia, 2008)
- ▶ Closed-end fund premium (discount)

$$Premium_{i,t} = (Price_{i,t} - NAV_{i,t}) / NAV_{i,t} \quad (2)$$

- ▶ Only consider top-ten holdings
  - ▶ Readily observable on the fund's website, factsheets, finance media, etc.
  - ▶ The entire positions is not likely to be available to investors

# CAPTURING CoMAX

- ▶ Lottery-likeness: Average top 5 daily returns within a month (Max5)
- ▶ Fund level Test
  - ▶ **For holdings:** Weighed average Max5 for top10 stocks (Holding\_Max5)
  - ▶ **For CEFs:** CEF\_Max5
  - ▶  $Ex\_Max5 = CEF\_Max5 - Holding\_Max5$
- ▶ Holding level Test
  - ▶ Top 10 holdings  $\Rightarrow$  45 ( $=10 \times 9 / 2$ ) stock pairs
  - ▶ **Pair\_Max5:** Weighted average Max5 for both stocks
  - ▶ **Co\_Max5:** % of the Max5 that happen at the same day(s)



- ▶ **Co-Maxing out Effect:**  $Pair\_Max5 \times Co\_Max5$
- ▶ Aggregate to fund level based on the sum of holding weights

# CAPTURING LOTTERY-LIKE FEATURES

- ▶ Holdings have stronger lottery-like features than the CEF itself
  - ▶ Holding\_Max5 > CEF\_Max5

**Table 2**

Panel A: CEF					
	Mean	Std Dev	25th Pctl	50th Pctl	75th Pctl
Distribution of Holdng's Max5	0.022	0.016	0.013	0.018	0.030
Distribution of CEF's Max5	0.014	0.010	0.008	0.011	0.015
CEF's Max5 – Holding's Max5	-0.009 (-34.44)				

# PANEL REGRESSION

**Table 3**

VARIABLES	Dependent Variable: CEF Premium						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ex_Max5	4.794*** (1.416)	1.068** (0.486)	0.990*** (0.352)				
Holding_Max5				-7.170*** (2.537)	-7.906*** (2.483)	-2.065** (0.944)	-1.211*** (0.409)
CEF_Max5				6.678*** (1.759)	6.256*** (1.895)	1.357* (0.777)	1.647** (0.662)
Pair_Max5×CoMax5					1.170** (0.468)	1.003** (0.402)	0.520*** (0.178)
CoMax5					0.0726 (0.933)	-0.624 (0.463)	-0.802** (0.381)
Controls	No	Yes	Yes	No	No	Yes	Yes
Fixed Effect	Time	Time	Fund, Time	Time	Time	Time	Fund, Time
Observations	2,330	2,330	2,330	2,330	2,330	2,330	2,330
R-squared	0.257	0.695	0.855	0.257	0.262	0.699	0.857

# EXPLAIN CORPORATE FINANCE TOPICS

## ▶ Mergers and Acquisition

$$\text{CombinedCAR}[-1, 1] = w_A \times \text{CAR}_A[-1, 1] + w_T \times \text{CAR}_T[-1, 1] \quad (3)$$

- ▶ High CoMax between the acquirer and the target improves market reaction towards a lottery-like deal.

## ▶ Conglomerates

$$\text{Premium}_{i,t} = (\text{MEBE}_{i,t} - \text{Imputed\_MEBE}_{i,t}) / \text{Imputed\_MEBE}_{i,t} \quad (4)$$

- ▶ High CoMax from lottery-like segments reduces diversification discount.



# CONCLUSION

- ▶ Provide a novel and unifying framework to understand three seemingly irrelevant asset pricing phenomena
  - ▶ The diversification in lottery-like features contributes to the portfolio pricing discount
  - ▶ Closed-end fund discount, M&A combined announcement return, and Diversification discount
- ▶ Support Barberis and Huang(2008) from an alternative prospective
  - ▶ Separately evaluate the value of the aggregate portfolio and the values of the underlying components
  - ▶ Isolate the effects of firm fundamentals