An Experimental Analysis of Contingent Capital Triggering Mechanisms

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[1] The views expressed here are those of the author and do not necessarily reflect the views of the Federal Reserve Bank of Richmond or the Federal Reserve System.

Contingent Capital

Debt that converts to equity when some trigger is breached

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Two Main Justifications

1. Mitigates debt overhang
2. Prepackaged failure resolution
   - Reduces chance of bankruptcy
   - Reduces government discretion

Variety of Proposals Advocating Contingent Capital (CoCo)

Flannery (2005), Raviv (2004), Huertas (2009), Plosser (2010), Squam Lake group (2010), D'Souza et al (2009), Rajan (2009), Calomeris and Herring (2011), Hart and Zingales (2011), McDonald (2010), Pennachi (2010)

Dodd-Frank mandates a study
UK - Independent Commission on Banking's report recommended
Swiss have implemented

The Trigger Problem

Three strategies

- Accounting based triggers
  - Based on book value of a bank
  - Lags actual condition
  - FDIC losses on failed banks high despite Prompt Corrective Action
- Regulator discretion
  - Squam Lake group - regulators declare systemic event then if bank-specific covenants also violated, get conversion
  - Time-inconsistency problem
    - Forbearance during U.S. S&L Crisis
- Market based - e.g., convert if price of equity below trigger
  - Advantages
    - Prices reflect market's information (e.g., Fama, Roll (1984))
    - Prices even have information bank supervisors don't have (e.g., Flannery (2005))
    - Reduces government discretion

What is This Paper About?

Provide experimental evidence on the effectiveness of market-based triggers in contingent capital.

Market-Based Triggers: What Do We Know?

Theory finds problems

Fixed price trigger

- Sundaresan and Wang (2010)

Regulator reacts to price

- Birchler and Facchinetti (2007)
- Bond, Goldstein, and Prescott (2010)

In all these papers: price of a security reflect both fundamentals **and** the chance of a conversion

- Creates a feedback between market prices and regulatory actions
- Can “mess up” prices

Market-Based Triggers: What Do We Know?

Data

All Coco issuances very recent.

- Rabo Bank, Lloyds, Credit Suisse (Feb 2011)

Too early to assess

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For these reasons, we decided to generate data with experiments

Key Features

Timing

$t = 0$: Risk-neutral traders observe θ, trade the asset ("equity")

$t = 1$: Price observed, trigger checked

$t = 2$: Asset payoffs are made

Asset's payoff

If trigger not breached: θ

If trigger breached: $\theta + f(\theta)$

Two cases in experiments:
Dilution: $f(\theta) = -T$
Non-dilution: $f(\theta) = T$

Definitions

Typical *trigger rule*: Convert debt to equity if $p < \hat{p}$.

Definition

An equilibrium is a price function, $p(\theta)$, such that

$$p(\theta) = \begin{cases} \theta + f(\theta) & \text{if } p(\theta) < \hat{p} \\ \theta & \text{if } p(\theta) \geq \hat{p} \end{cases}.$$

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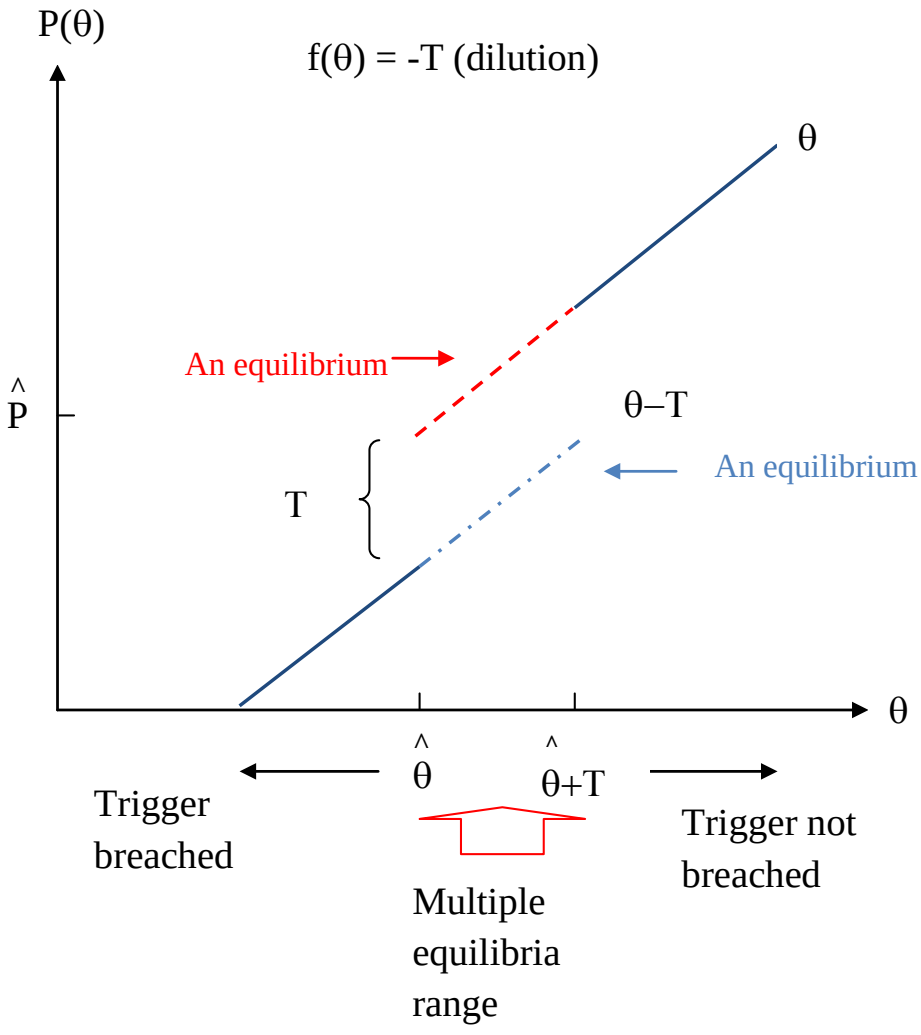
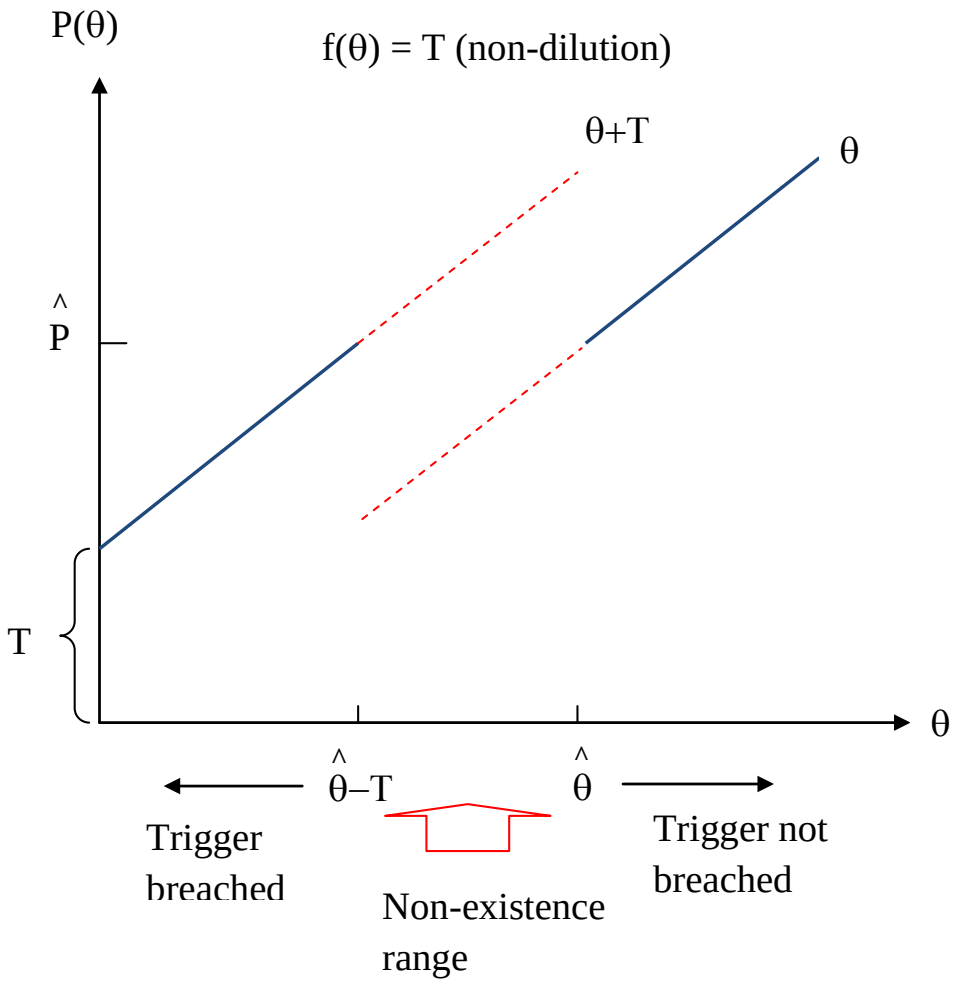
Problem: multiple equilibria and non-existence

Dilutive Trigger Rules: Multiple Equilibria



Non-dilutive Trigger Rules: Non-Existence of Equilibria



Regulator Problem

Replace fixed-price trigger with a regulator

Give regulator trigger-like preferences over when to convert

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Dilution - Unique equilibria exists
Non-dilution - Non-existence over range $[\theta - T, \theta + T]$

Economic Experiments

Advantages

- Can design experiments to isolate effects you want to study
- Just like a laboratory in the natural sciences
- Cheaper and safer than policy experiments

Disadvantages

- New tool in economics - unclear how well it matches to real life
- Stakes lot smaller than real life
- Subjects are usually college students, not experienced traders

Notable successes - testing auction procedures, e.g., for wireless bandwith

Experiment Details

Traders

- 10 traders, each has two units of the asset and cash of \$16
- 6 value asset at θ, 4 at $\theta - 0.60$
- a trader knows own valuation, buys and sells the assets

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Fixed Trigger Rule

- If median price less than $5.00, trigger breach
- Conversion adds (or subtracts) $2.00 to θ.

θ in range of [$2.00,$8.00].

Regulator Experiments

Replaced fixed trigger with people

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Monitors (regulators)

- 3 monitors, each cares about θ
- can convert, which adds (or subtracts) \$2.00 to θ
- receives \$10 if converts when $\theta <$ \$5.00
- receives \$10 if does not convert when $\theta >$ \$5.00
- also guesses θ, receives \$3.00 if within \$0.20 and \$1.00 if within \$0.50
- only one monitor's conversion decision matters, chosen randomly
- Don't know trader valuations, only see price

Then added prediction markets in whether there was conversion

- Traders traded this security (before asset traded)
- Monitors see both prices

Experiment Details (cont.)

Timing

- Trader's see own valuation
- Post prices they are willing to buy or sell at (open book double auction)
- Trading lasts for 110 seconds
- After trading, trigger checked
  - If monitor - see median price and make conversion decision
- Payouts to participants are then determined

The Experiments

Background

- Participants were 424 VCU undergraduate volunteers.
- Ran 16 twenty-period sessions with monitor.
- Ran 12 twenty-period session with prediction markets.
- Ran 6 twenty-five period sessions with fixed price trigger.
- Lab earnings converted to U.S. currency at a rate of \$12 lab = \$1 U.S.
- Sessions took 90-105 minutes.
- Earnings ranged from \$14 to \$28 (average of \$23.50) (included a \$6 appearance fee).

Each session had 5 baseline periods with no conversions.

Efficiency Criteria

Three Measures

1. Price efficiency - deviation of median price from final asset value
2. Allocative efficiency - fraction of assets that ends in possession of high-value traders
3. Conversion error rate - fraction of times conversion occurs when $\theta > 5$ or when no conversion and $\theta \leq 5$.

Baseline Results (no trigger)

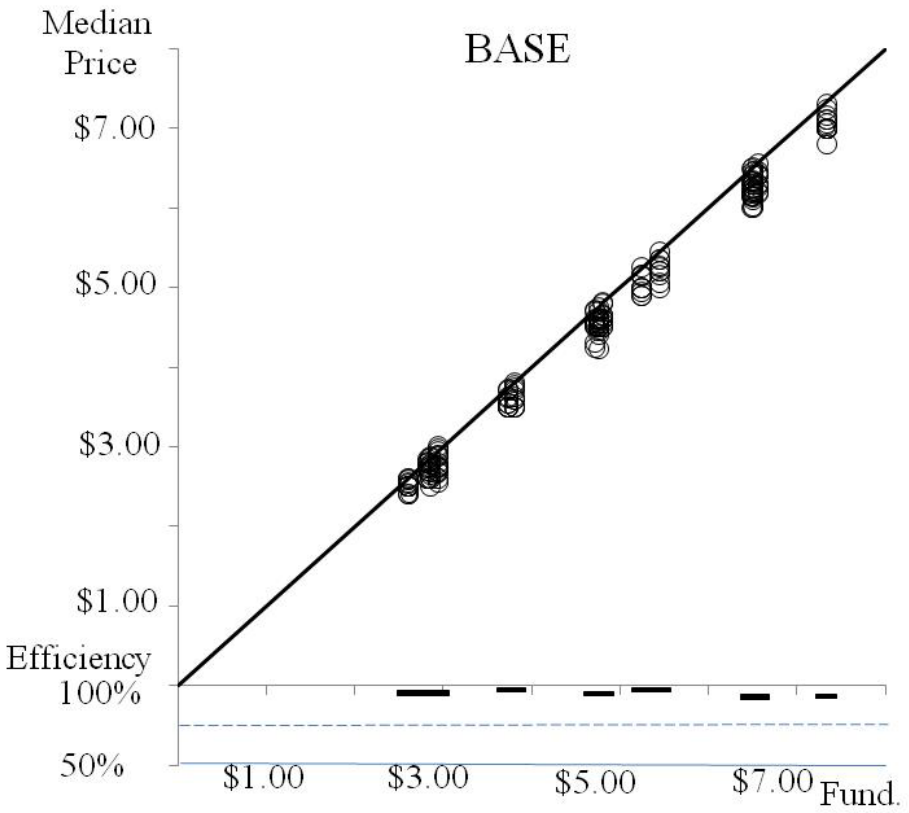


Figure 4. Median Contract Prices vs. Fundamental Realizations in the *BASE* Condition.
Key: Circles indicates median contract prices. Horizontal bars at the bottom of the figure indicate mean allocative efficiencies.

Fixed Price Trigger: Dilution

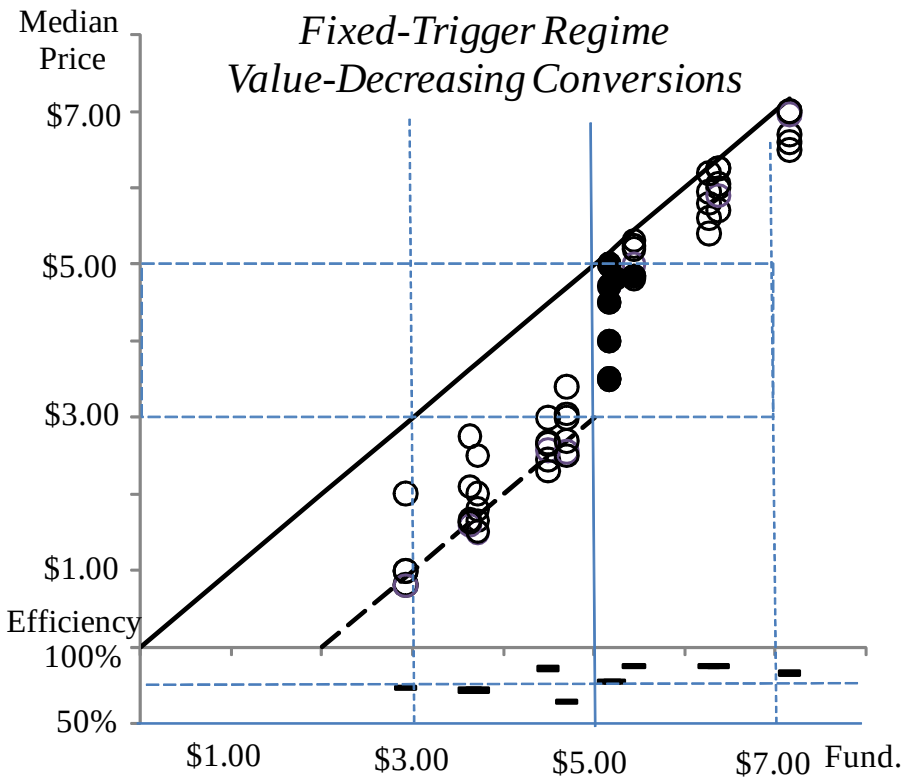


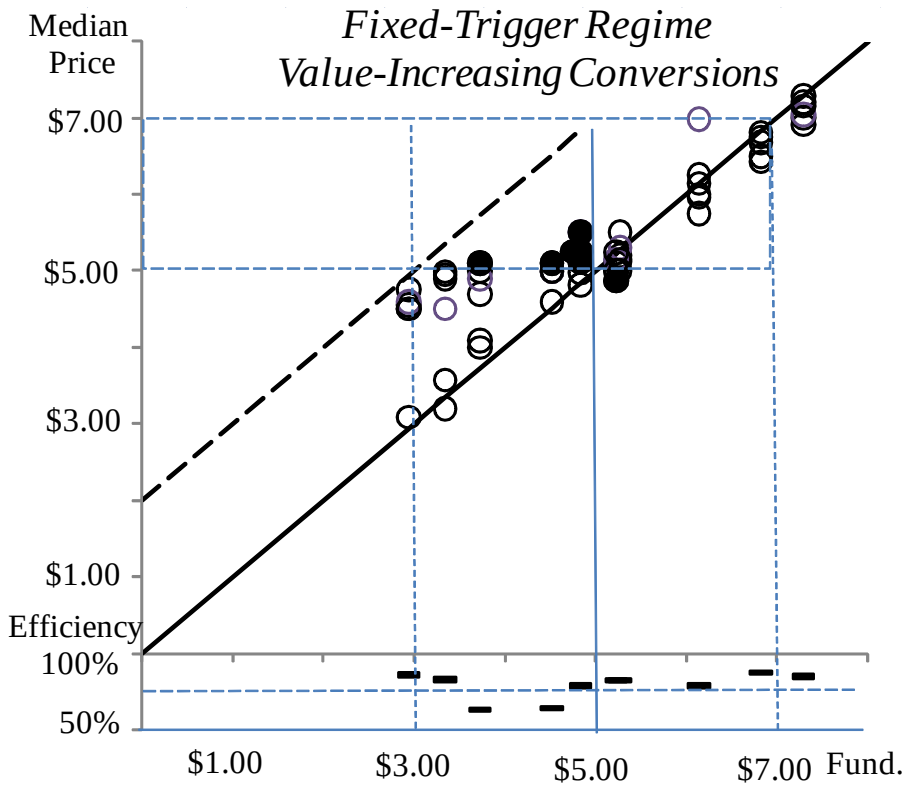
Figure 6. Median Contract Prices vs. Fundamental Realizations in the *Fixed Trigger* treatments. *Key*: Hollow dots indicate median contract prices. Black fillings indicate instances of intervention errors. Bars at the bottom of the page reflect mean allocative efficiencies.

Fixed Price Trigger with Dilution: Regression Results

	Price Effic. $\lvert P_{med} - P_{fx} \rvert$	Allocative Efficiency	Conversion Error Rate
Cons	\$0.21*	95%*	
Active	\$0.07	-20%*	0
MultiEq	\$0.25*	10%*	33%*
N	230	230	60
Wald ξ^2	13.26*	81.74*	

Key: * indicates rejection of the null that the coefficient equals zero, $p < 0.05$ (2-tailed test).

Fixed Price Trigger: Non-Dilution



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Fixed Price Trigger with Non-Dilution: Regression Results

	Price Effic. $\lvert P_{med} - P_{fx} \rvert$	Allocative Efficiency	Conversion Error Rate
Cons	\$0.21*	95%*	
Active	\$0.06*	-11%*	3%
Ambigft	\$1.07*	-11%*	35%*
N	230	230	60
Wald ξ^2	96.77*	60.95*	8.7*

Key: * indicates rejection of the null that the coefficient equals zero, $p < 0.05$, respectively (2-tailed test).

Regulator: Dilution

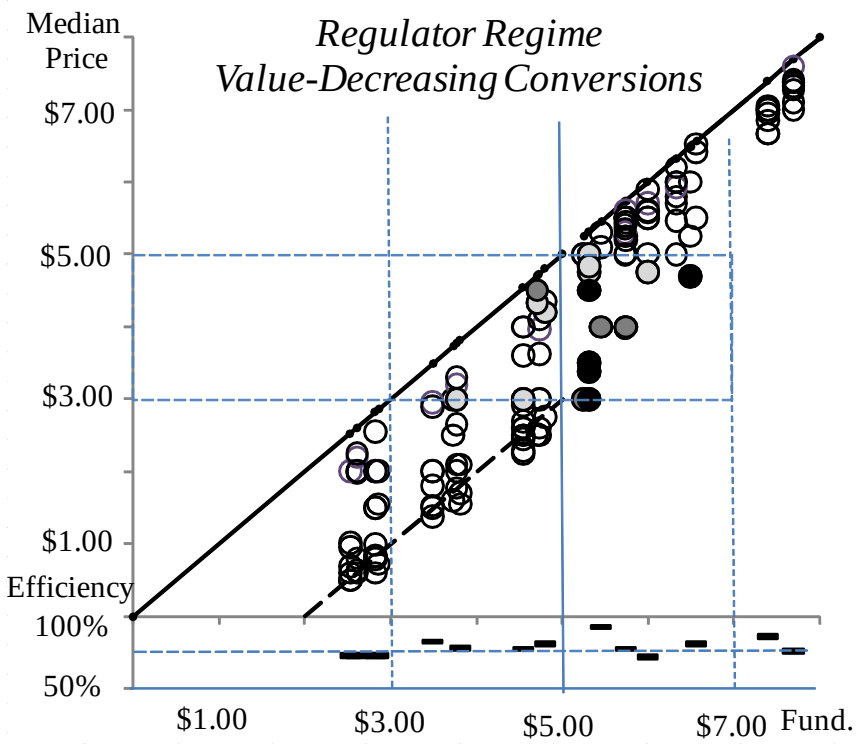


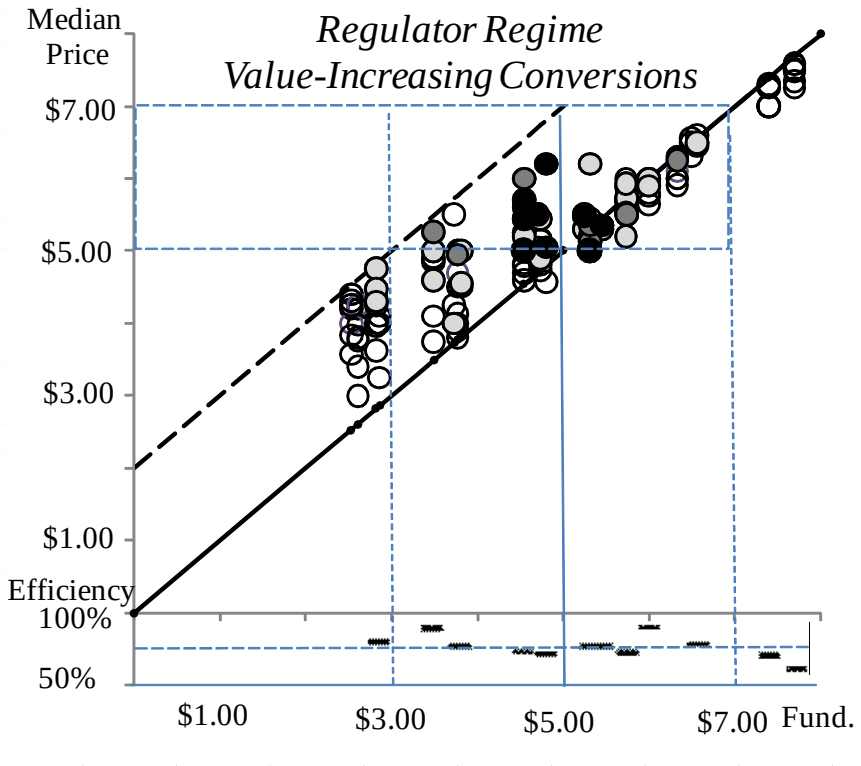
Figure 5. Median Contract Prices vs. Fundamental Realizations in the *Regulator* treatments. *Key*: Dots indicate median contract prices. Light gray, dark gray and black dots indicate instances of 1, 2 and 3 intervention errors, respectively. Bars indicate mean allocative efficiency.

Regulator with Dilution: Regression Results

	Price Effic. $\lvert P_{med} - P_{fx} \rvert$	Allocative Efficiency	Conversion Error Rate
Cons	\$0.21*	95%*	
Active	\$0.42*	-16%*	8%*
N	320	320	150
Wald ξ^2	36.4*	154.8*	

Key: * indicates rejection of the null that coefficient equals zero, $p < 0.05$ (2-tailed test).

Regulator: Non-Dilution



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	Price Effic. $\lvert P_{med} - P_{fx} \rvert$	Allocative Efficiency	Conversion Error Rate
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Active	\$0.29*	-11%*	3%**
Ambig	\$0.26*	-10%*	22%*
N	320	320	150
Wald ξ^2	121.2*	162.1*	29.2*

Key: * and ** indicates rejection of the null that coefficient equals zero, $p < 0.05$ and $p < 0.10$, respectively (2-tailed tests).

Fixed-Price Trigger vs. Regulator

Dilution

- Price efficiency - both losses, regulator worse
- Allocative efficiency - sizable, similar
- Conversion error - For both errors most frequent above trigger
  - All fixed trigger errors **right** above trigger
  - Regulator errors in wider range of values

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Non-dilution

- Price efficiency - both losses, biggest problems below trigger
- Allocative efficiency - equally sizable losses
- Conversion error - Fixed trigger worse (all from ambiguous region)
  - But, fixed trigger errors **near** trigger

Could a Prediction Market Help?

Theory says ”Yes”

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Theory says ”Yes”
Added a prediction market

- Traders traded a security that paid off 1 if the regulator converted and 0 if not.
- Each trader starts with one unit of this security.
- Used a call market. Each trader submitted a maximum bid to buy and a minimum bid to sell. Crossing point found and exchanges occur.
- Traded after knowing their θ, but before trading the asset.

Regulator with Prediction Market: Dilution

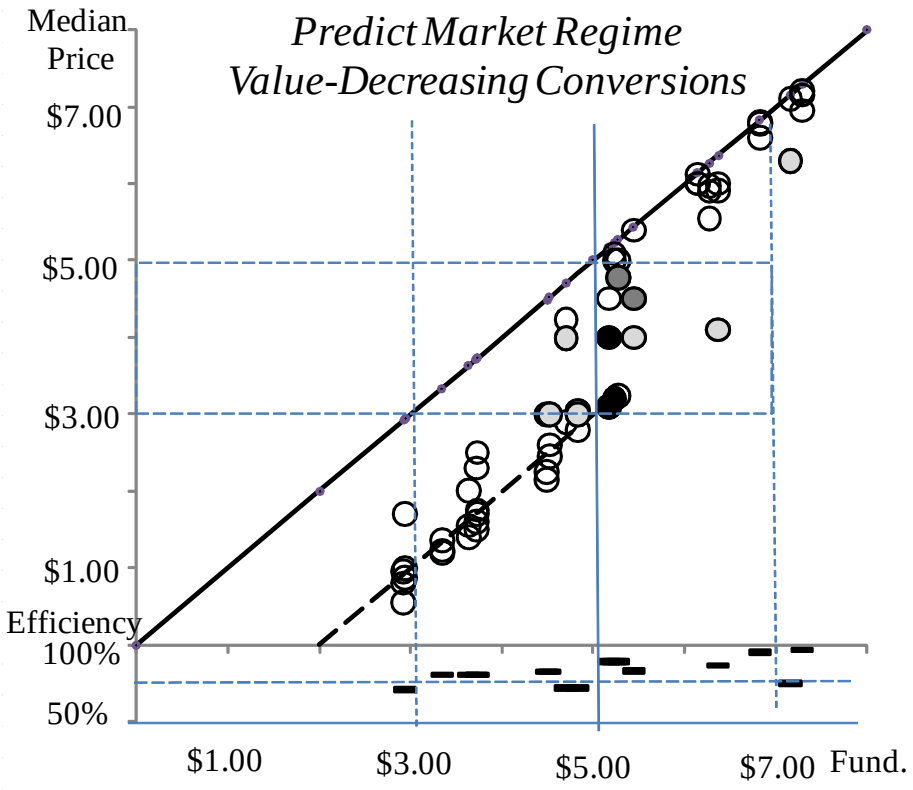
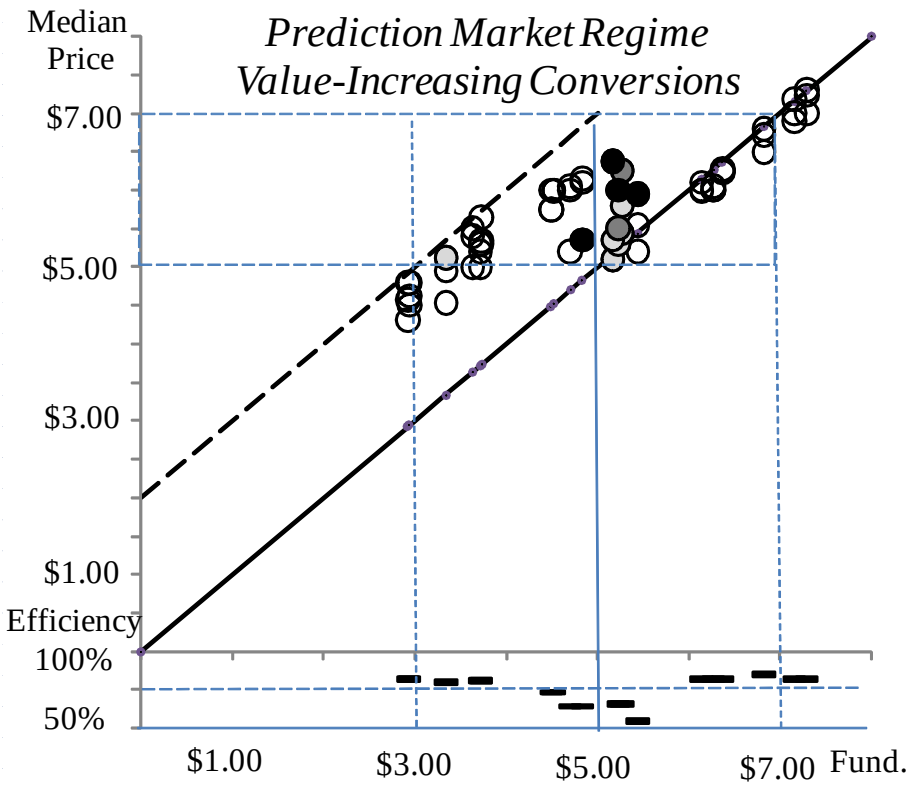


Figure 7. Median Contract Prices vs. Fundamental Realizations in the *Prediction Market* treatments. *Key*: Dots indicates median contract prices, light gray, dark gray and black dots indicate instances of 1, 2 and 3 intervention errors. Bars indicate mean allocative efficiency.

Regulator with Prediction Market: Non-Dilution



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Regulator vs. Regulator with Prediction

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- Price efficiency - Prediction market better
- Allocative efficiency - About the same
- Conversion error - Prediction market slightly worse

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Non-Dilution

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Substantial inefficiencies still remain

Price Efficiency and Conversion Errors

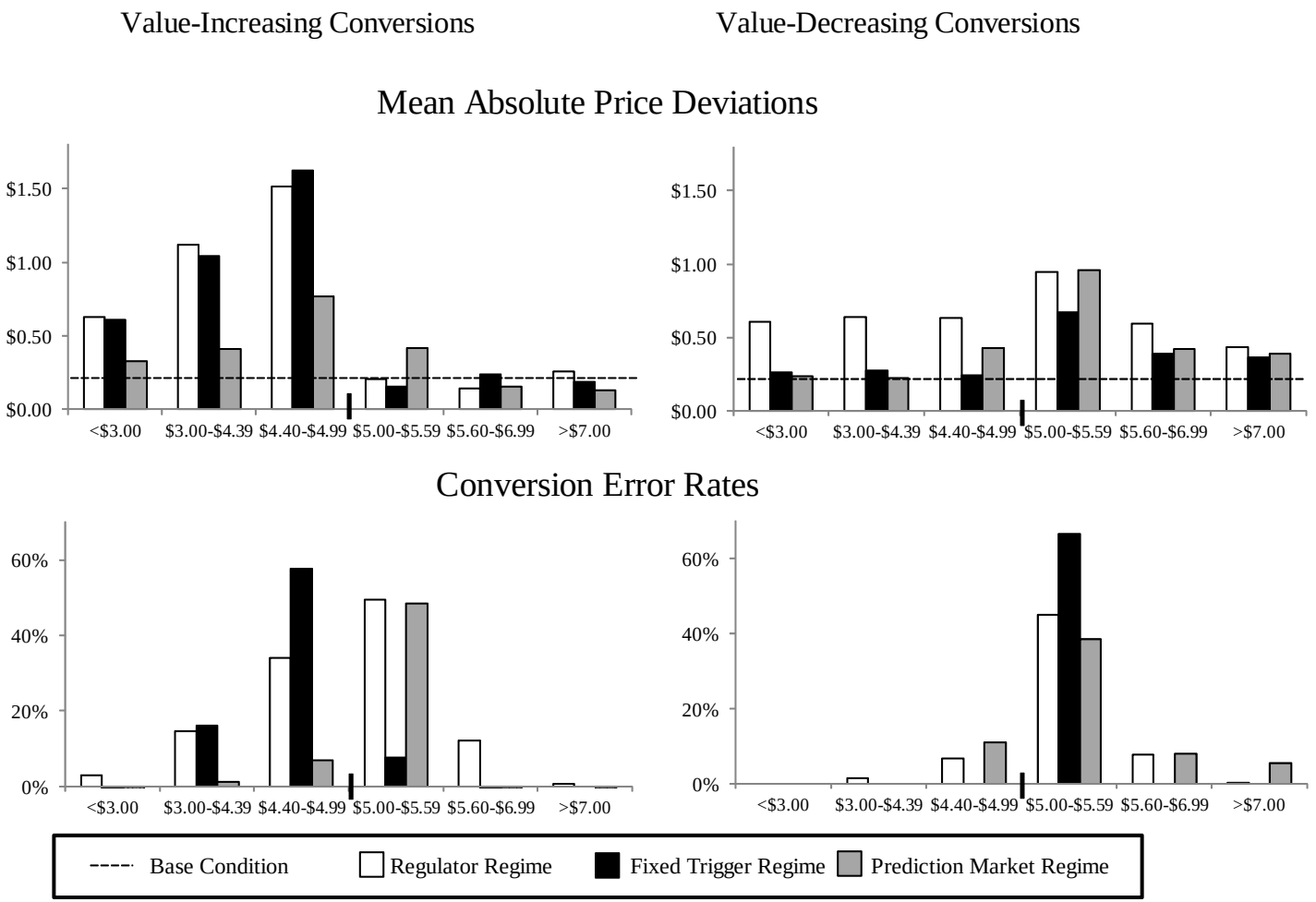

Figure 8: Mean Absolute Price Deviations and Conversion Error Rates by Segments

Summary

Fixed-price Triggers

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  - Worse in non-dilution case
- Hurts allocative efficiency
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Regulator

- Little improvement on allocative efficiency
- Worsens price efficiency in dilution case
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Regulator with Prediction Market

- Improvement relative to regulator
  - Strongest in non-dilution case, also with price efficiency
- Substantial inefficiencies remain

Conclusion

The Trigger Problem is a serious problem for contingent capital

- Theory evidence
- Experimental evidence

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Theory suggests several strategies worth pursuing to solve this problem

- Try smoother conversion rules
- Make fixed-price trigger depend on a prediction market as well

These and others should be explored.