

An Experimental Study of Real Estate Market Efficiency

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Objective

- **At the root of the current turmoil:**
 - **Bubble in US real estate markets**
- **What causes bubbles?**
 - **Exotic derivative products?**
 - **Agency / incentive problems in the financial / appraisal system?**
 - **Rating issues?**
 - **All / None of the above?**

Objective

- The objective is to provide experimental evidence on the impact of some of the attributes of real assets on the efficiency of real estate markets.
- We focus on three characteristics of real estate:
 - Transaction costs
 - Short selling restriction
 - Divisibility of the asset
- Do these characteristics of real estate have any effect on the efficiency of the market?
 - Our focus in this paper is on *informational efficiency*
 - bubble and bust formations

What Bubble? Efficient Markets?

- *“Well, if there really were a \$20 bill on the sidewalk, someone would have picked it up already.”*
- **Some argue that even the tech stock prices in late 1990s were justified**
 - **Pastor & Veronesi (2006, *JFE*) show that fundamental value of a firm increases with uncertainty about future profits, and this uncertainty was unusually high in the late 1990s.**

Is Price really > Fundamental Value?

DRAWN & QUARTERED

I'm asking
\$749,000⁰⁰

THAT'S IT!
This
housing
bubble has
gotta burst
already...

FOR
SALE

MARGULIES

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Methodology: Experiments

Why Experiments?

- **Control over the environment and variables – allows for comparison of alternative theories.**
- **The fundamental value of the asset can be determined with certainty.**
- **Information set of players can be controlled.**

Literature review

- **Extensive theoretical, empirical and experimental literature on market efficiency (Hayek, 1945; Muth, 1961; Fama, 1970; Lucas, 1972; Grossman, 1976)**
 - **Large literature on RE market efficiency as well (Linnemann, 1986; Gau, 1987; Case and Shiller, 1989; Fu and Ng, 2001)**

Literature Review: Bubbles in the Lab

- ***Smith, Suchanek, and Williams “Bubbles, crashes, and endogenous expectations in experimental spot asset markets” (Econometrica, 1988): Bubbles observed in 18 of 22 sessions. Bubbles are often followed by “crashes”.***
 - **This is surprising, considering the simplicity of the trading environment.**
- **But many later studies have replicated these results:**
 - *King et al. (1993, Oxford University Press)*
 - *Van Boening et al (1993, Economic Letters)*
 - *Porter and Smith (1995, Journal of Business)*
 - *Noussair, Robin, Ruffieux (2001, Experimental Economics)*
 - *Lei, Noussair, Plott (2001, Econometrica)*
 - *Haruvy and Noussair (2006, Journal of Finance)*

Experimental Design and Procedures

- **Based on *Smith et al (1988. Econometrica)*.**
 - **traders with identical dividend structure**
 - **Asset pays dividends for 15 periods and has zero terminal value.**
 - **Fundamental value of asset is expected value of dividend payments.**
- **“Computerized double auction” trading mechanism.**
- **subjects trade in 15 four-minute periods.**

Main Trading Screen

Period

1

Remaining Time [sec]: 7

Money

8015

Ask Price

1100
1005
990
950
930

Purchase price

980
960
995

Bid Price

780
820
850
885

Shares

4

Enter ask price

Enter bid price

SUBMIT ASK PRICE

BUY

SELL

SUBMIT BID PRICE

Experimental Design and Procedures

- **Actual earnings ranged from US\$6.81 to US\$41.21 for a 90-minute session.**

Design Parameters

Treatment	Dividend, francs ($p=1/4$)	Expected dividend per period, francs	Intrinsic (dividend) value per share in Period 1, francs
NSS-TC	(0, 8, 28, 60)	24	360
NSS	(0, 8, 28, 60)	24	360
SS	(0, 8, 28, 60)	24	360
SS-MA	(0, 2, 7, 15)	6	90
NSS-MA	(0, 2, 7, 15)	6	90

The expected earning for all trader types is the same (\$18.05) in all four treatments.
Exchange Rate: 100 Francs=\$1

Miscalculation not an excuse / explanation!

The following table has been provided to subjects

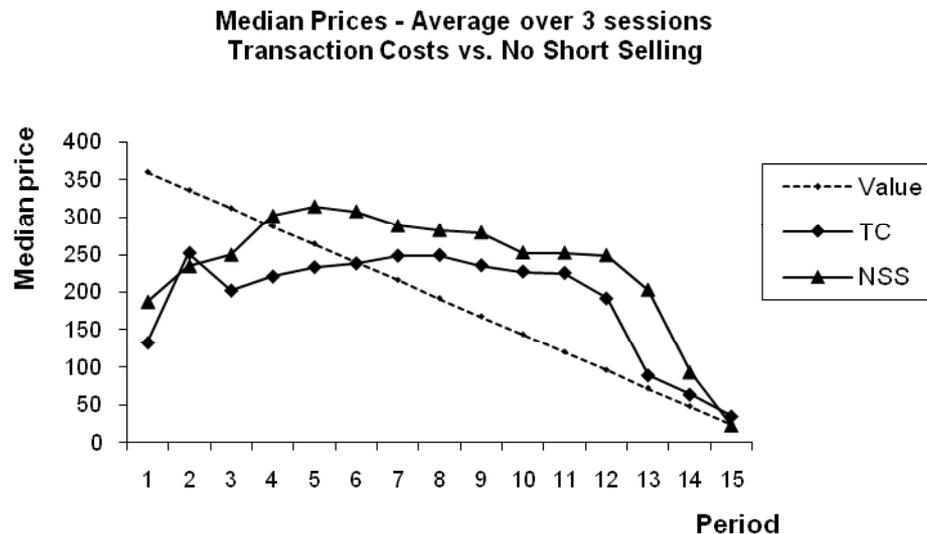
AVERAGE HOLDING VALUE TABLE

Ending Period	Current Period	Number of Holding Periods	x	Average Dividend Per Period	=	Average Holding Value Per Share in Inventory
15	1	15		24		360
15	2	14		24		336
15	3	13		24		312
15	4	12		24		288
15	5	11		24		264
15	6	10		24		240

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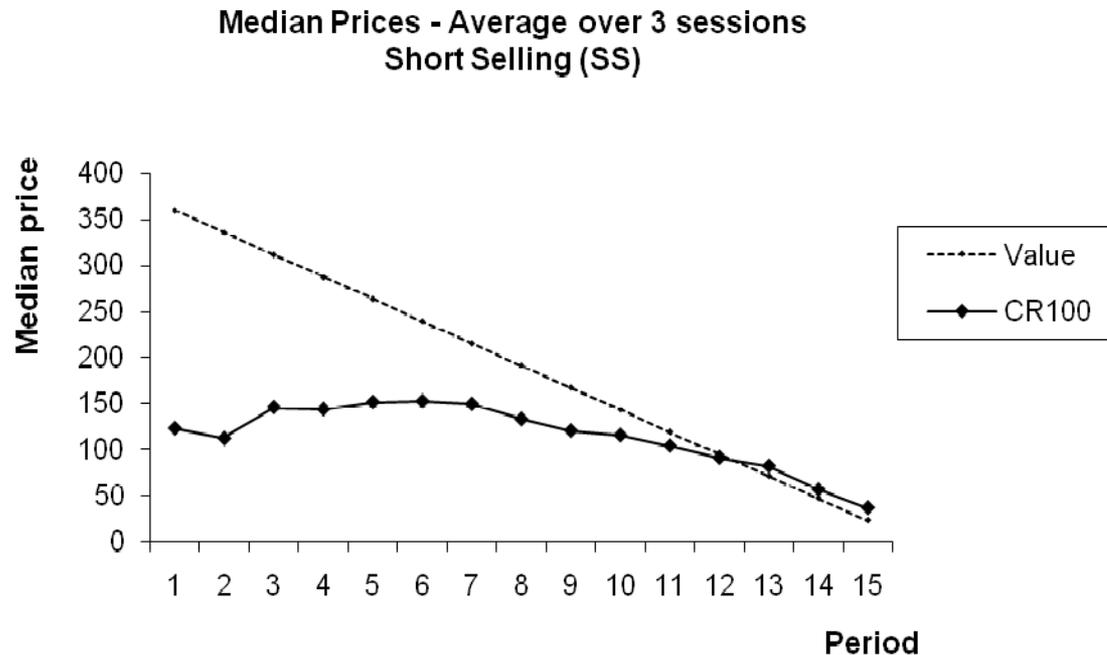
Result 1

- The difference between the observed prices and fundamental values is smaller with **transaction costs**.
- The means of median prices in the TC treatment are not statistically different from the fundamental values (becomes significant in the last 10 rounds).



Result 2 & 3

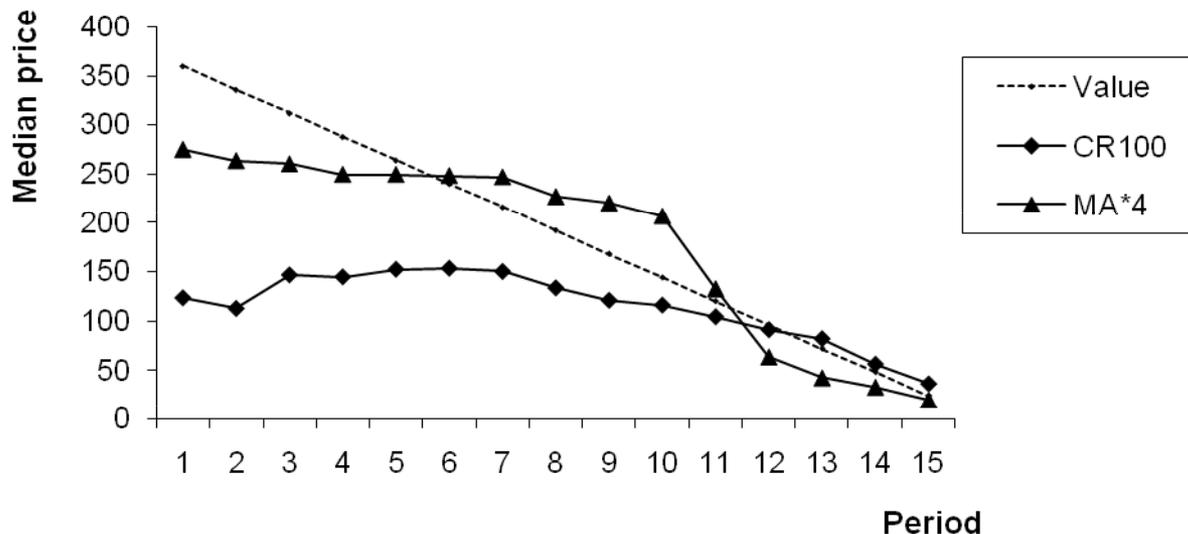
- With **short selling**, prices do NOT follow fundamentals.
- Prices are lower when short selling is allowed.



Result 4

- Prices track fundamental values more closely in a market with **divisible assets** than in a similar market with lumpy assets.
- Neither *Boom cycles* (6 periods on average) nor *Bust cycles* (3.7 periods) are very long.

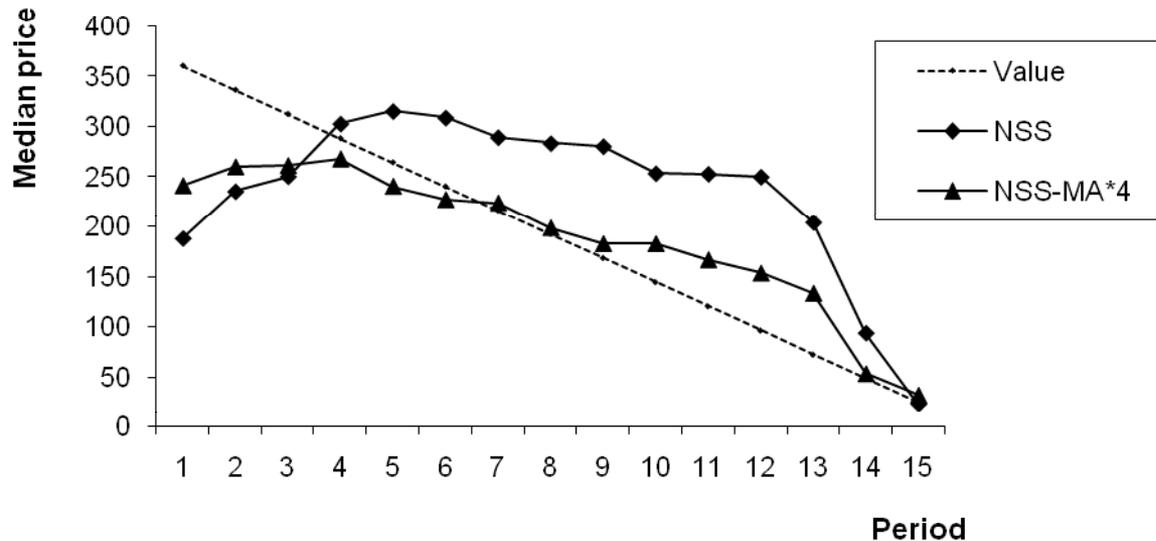
Median Prices - Average over 3 sessions
Short Selling: Bulky Assets vs. Divisible Assets



Result 5

- Prices track fundamentals more closely in a market with **divisible assets even when short selling is not allowed.**
- Median prices in NSS-MA are not statistically different from fundamental values.

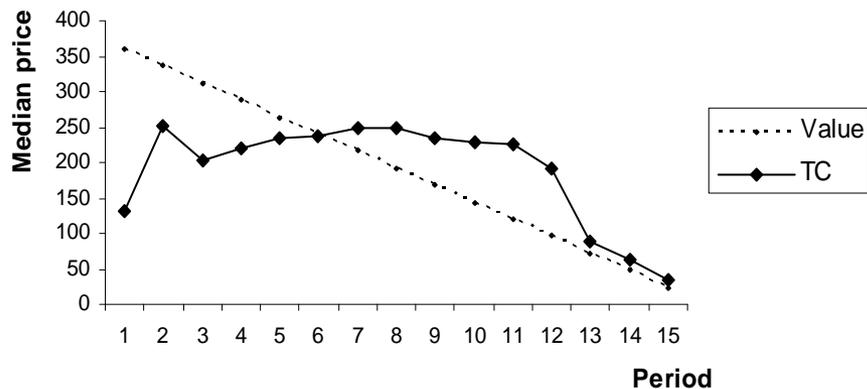
Median Prices - Average over 3 sessions
No Short Selling: Bulky Assets vs. Divisible Assets



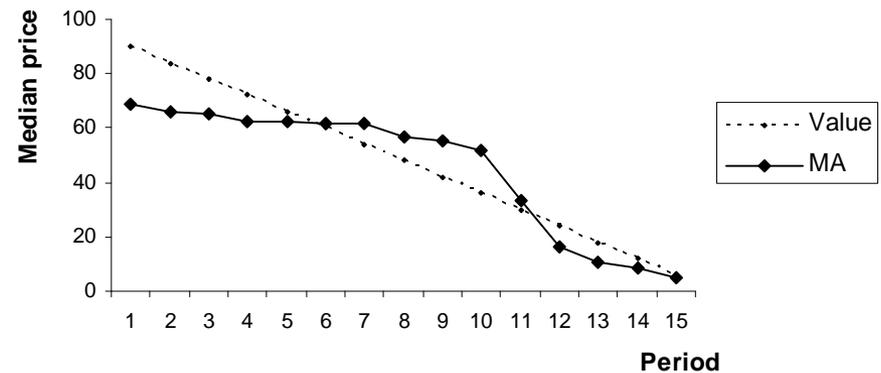
Result 6

- Compared to the experimental market closest to **financial markets**, the experimental market closest to **real estate markets** involves higher median asset prices, longer boom and bust periods and lower turnover.

Median Prices - Average over 3 sessions
Transaction Costs and No Short Selling



Median Prices - Average over 3 sessions
Divisible assets and Short Selling



Wilcoxon test results – All 15 periods

Null hypothesis: The difference of means of median prices in two samples = 0

	FundP	NSS-TC	NSS	SS	SS-MA
NSS-TC	-0.18 (0.859)	-	-	-	-
NSS	1.88 (0.060)*	2.17** (0.029)	-	-	-
SS	-3.52*** (0.000)	-4.53*** (0.000)	-4.90*** (0.000)	-	-
SS-MA	-0.54 (0.588)	-0.46 (0.643)	-2.15** (0.032)	2.88*** (0.004)	-
NSS-MA	-0.190 (0.850)	-0.49 (0.623)	-2.12** (0.034)	3.657*** (0.000)	0.367 (0.714)

* Median prices for the SS-MA and NSS-MA treatments are multiplied by 4.

A Theoretical Challenge

- **Theoretical Prediction?**
- **Asset prices have moved too much to be explained by subsequent changes in dividends...**

Common Information leading to Different Expectations?

- **Different Risk Attitudes?**
- **Lack of Belief in Rationality of Others?**
- **“Trend” / “feedback” / “momentum” Traders: Overconfidence to exit market prior to crash to “beat the gun”?**

A Theoretical Challenge

- **Finite Horizon Game – Can a bubble form with a known ending period?**
- Last Period Prices very close to Fundamental Prices.
Backward Induction: Limited Number of Iterations (prior evidence)

Conclusions - I

- **Effects of three characteristics of real estate on market efficiency are measured in an experimental setting.**
- **Results:**
 - **Transaction costs do not reduce the efficiency of this experimental asset market.**
 - **Prices are lower and they do not track fundamentals when short selling is allowed. However, the impact of short selling becomes negligible when assets are divisible.**
 - **Making the asset more divisible improves the efficiency of the market, both when short selling is and is not allowed.**

Conclusions - II

- **Bubbles & Crashes can take place in very simple environments with little/no uncertainty about future cash flows (no need for exotic derivative mortgage products, agency problems, etc.)**
- **But institutions matter for the duration and magnitude of bubbles.**