

# Cognitive Reference Points, the Left-Digit Effect, and Clustering in Housing Markets

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# What is the left-digit effect?

Houses with a smaller left-digit listing price are perceived to have a larger difference in price (\$100 vs. \$1,000)

For example:

**299,900** and **300,000**

**329,900** and **330,000**

# Main Results

Properties listed with a smaller left-digit are

- 3.8 % more likely to sell
- Stay on the market 5% fewer days
- Sell for 0.1% higher price

Buyers of those houses are more likely to:

- Have a lower credit score
- Lower income
- Higher leverage ( back-end ratio)
- Less financially sophisticated ( refinancing behavior)

# Main Comments

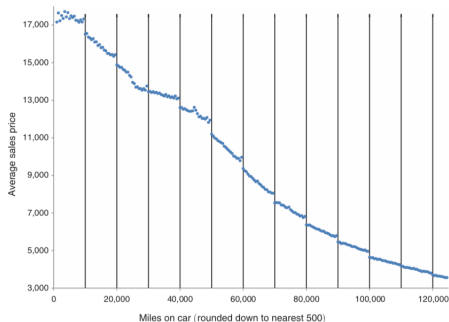
1. Magnitude and interpretation
2. Empirical strategy and identifying assumption
3. Other comments

# Comments 1: Magnitude and Interpretation

**Effects are statistically significant, but what about economic magnitude?**

Left-digits effect in the literature **“Car sales.”**

Lacetera et al. (2012), show similar effect for cars wholesale auctions base on “car milage.”



## Comments 1: Magnitude and Interpretation

Lacetera et al. (2012) effect:

-\$157 higher for average of \$11,203 (fleet or lease)

-\$173 higher for average price of \$9,346 (dealer)

Car Markets **1.4-1.85%**

Housing Markets **0.1%** ( this paper)

**Bias seems to be smaller in the housing market for final sale price**

## Suggestion 1: Magnitude and interpretation

**Behavioral bias decreases with the importance of the purchase**

- Reject the idea of “penny wise and dollar foolish”?
- Compare results to existing literature

**Is it driven by household demographics or by market forces?**

Lacetera et. al. (2012) is wholesale auctions

Heterogeneity results are consistent with factors that reduce behavioral biases:

types: more educated (smaller effect)

market forces: high turnover/more bids (smaller effect)

## Comments 2: Empirical strategy and identifying assumption

$$y_i = \beta \times \text{LeftDigit}_i + FE_{pp_i} + \Gamma X_i + \text{ListingQ}_i + \text{Zipcode}_i + \varepsilon_i$$

where:

$FE_{pp_i}$  is price pair fixed effect (\$199,900-\$200,000 ; \$200,900-\$201,000;...)

$X_i$  is a vector of observable house characteristics

$\text{ListingQ}_i$  is the quarter-year of the listing

$\text{LeftDigit}_i$  is within each price pair bin an indicator of the smallest left-digit price

### Identifying assumptions:

- After controlling for rich set of observables, differences in outcomes are due to behavioral biases



## Comments 2: Regression Sample

Main results only used transaction in 900 to 1000 price bins, graphically

199,900

200,000

200,100

200,200

...

200,800

200,900

201,000

201,100

201,200

...

201,800

201,900

202,000

202,100

### Suggestion:

Compare regression sample (Table 1 Panel A) to All MLS sample

Assess potential selection bias

## Comments 2: Empirical Strategy

In an RD setup, the ideal specification for N “price pairs” is:

$$y_i^1 = \alpha_0 + \alpha_1^1(P_i - P_r^1) + \alpha_2^1(P_i - P_r^1 < 0) + \nu_i^1$$

$$y_i^2 = \alpha_0 + \alpha_1^2(P_i - P_r^2) + \alpha_2^2(P_i - P_r^2 < 0) + \nu_i^2$$

...

$$y_i^N = \alpha_0 + \alpha_1^N(P_i - P_r^N) + \alpha_2^N(P_i - P_r^N < 0) + \nu_i^N$$

## Comments 2: Empirical Strategy

Pooled by Price Pair ( $P_r$ )

$$y_i = \beta_0 \times P_r + \beta_1(P_i - P_r) \times P_r + \alpha_2^1(P_i - P_r^1 < 0) \times P_r + \epsilon_i$$

$$y_i = FE_{ppi} + FE_{ppi} \times (P_i - P_r) + \beta \times LeftDigit_i + \epsilon_i$$

$$y_i = FE_{ppi} + \beta \times LeftDigit_i + \epsilon_i$$

Therefore we need: a) frequency to be smooth and b) covariates to be continuous around the threshold.

However, summary stats and regression in the paper are inconsistent

- Bunching on the left or right?
- Differences concerning to characteristics, Table 8

## Suggestion 2: Empirical Strategy Interpretation

Not a regression discontinuity, but an “estimation of the discontinuity”

Suggestion:

$$y_i = \beta \times \text{LeftDigit}_i + FE_{pp_i} + \Gamma X_i + \text{ListingQ}_i + \text{Zipcode}_i + \varepsilon_i$$

- Control for the interaction of “price pair” x “zipcode” x “listing quarter.”
- Provide more evidence about distribution of transaction around the threshold
- Embrace endogeneity

## Suggestion 2: Embrace endogeneity

What is driving the difference allows us to learn about demographics of people generating the “bias”?

	(1)	(2)
	Smaller	Left Digit x 100
FICO $\leq$ 620 Dummy	-0.037 (-0.08)	1.660*** (-4.20)
Minority	-0.348 (-1.47)	0.372* (-1.70)
Backend Ratio	-8.127*** (-9.16)	2.880*** (-3.47)
Ln(Income)	-6.293*** (-29.96)	-0.690*** (-2.85)
Mortgage Attributes	Yes	Yes
Origination YYQQ FE	Yes	Yes
MSA FE	Yes	Yes
Price Pairs	No	Yes
N	217880	217880
adj. R <sup>2</sup>	0.074	0.285

Based on Table 8, baselines outcomes may be overestimating the difference  
⇒ “real behavioral bias” smaller

## Suggestion 2: Placebo Test

Define not on 900 and 1000 pair

199,900  
200,000  
200,100  
200,200  
...  
200,800  
200,900  
201,000  
201,100  
201,200  
...  
201,800  
201,900  
202,000  
202,100

Define left digit as the smaller number, instead of 200,900 and 201,000, do 200,400 and 200,500

Replicate for many combinations and compare to “real” left-digit regression

## Comments 2: Not all pairs are the same

Table 6 suggest that the effect is from 329,900 compared to 330,000.

Not from 299,900 and 300,000

	(1)	(2)	(3)	(4)
	SOLD	DOM	Log(Price)	Price
Smaller Left Digit	5.249***	-7.258***	0.004***	468.9***
	34.73	(-21.54)	4.57	(8.15)
x Listing Price @ \$100,000	1.238***	1.026	-0.005**	-1256.9***
	4.21	1.2	(-2.31)	(-6.18)
x Listing Price @ \$200,000	-1.773***	1.712	-0.013***	-1549.5***
	(-4.09)	1.46	(-3.35)	(-5.61)
x Listing Price @ \$300,000	-2.447***	4.497***	0.003	-1594.0***
	(-4.92)	3.15	0.32	(-3.63)

### Explanation?

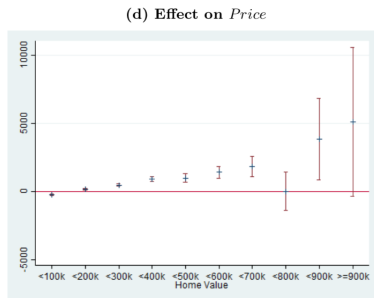
\$100,000 thresholds are search thresholds and perceived as high quality

Another evidence than “real behavioral bias” is small

# Other comments

## 1. @ \$800,000 bin behave differently

- Effects on 800k bin is very different, what is special about 800k?



## 2. Differences between high and low turnover periods

- It is unclear that is about bargaining power and not market conditions



# Conclusion

Interesting paper

A change in the narrative will enhance the contribution

Looking forward to reading the new version