Behavioural Lock-In: Aggregate Implications of Reference Dependence in the Housing Market

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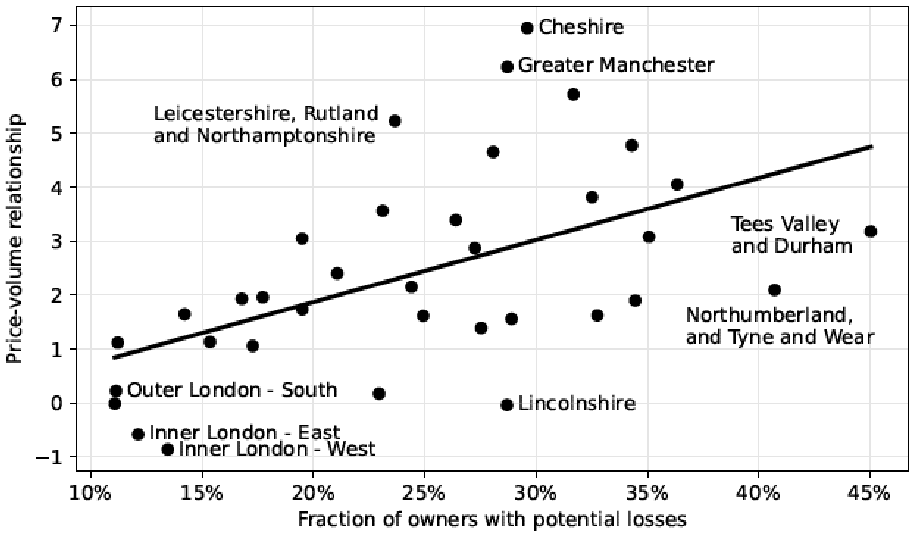
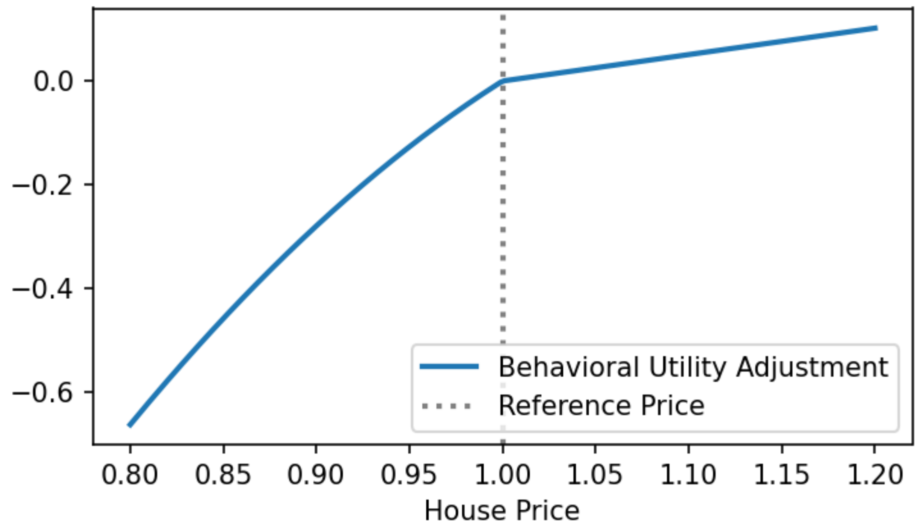
Introduction

- **Question:** how does reference dependence (unwillingness to take a nominal loss on a property sale) affect the housing market?
- **Approach:** empirical work using transaction data + rich structural model
- **Main results:**
  - Less volume when more households have fundamental (hedonic regression) price below their reference (previous transaction) price
  - Slope of this relationship is steeper when more households are at risk of loss
  - Model: entire distribution of reference prices is a state variable!
  - Policy implications for response to, design of, property tax changes
- **My evaluation:** convincing results, but hard to distinguish from credit effects

Empirical motivation for loss aversion

- Left plot shows positive relationship between price change and volume
  - Relationship is stronger when more house values are below reference price
- Paper explains this using asymmetric utility adjustment in difference between selling price and reference price (right plot)
  - Benefit of selling increasing in difference, more so when negative





The ideal experiment

- The **ideal experiment** to test for reference dependence:
  - Randomly assign reference prices across households
  - Observe behavior by reference price, holding fundamentals fixed
- **Main challenge:** reference prices are not assigned randomly
  - This paper: reference price is the previous transacted price
  - Whether fundamental price is above or below reference price reflects returns (gains or losses) on household's housing position
  - Difficult to control while keeping variation in fundamental vs. reference price
- **This discussion:** three examples of how credit structure could generate this asymmetry without any psychological reference dependence

Model #1: occasionally binding constraints

- Simple allocation problem over consumption (c) and housing (h):

$$\max_{c,h} \; (1-\xi)\log(c) + \xi\log(h)$$
$$s.t.\; c + ph \leq a + y$$

  where a is financial wealth and y is income.

  - Solution: set $ph^* = \xi(a+y)$

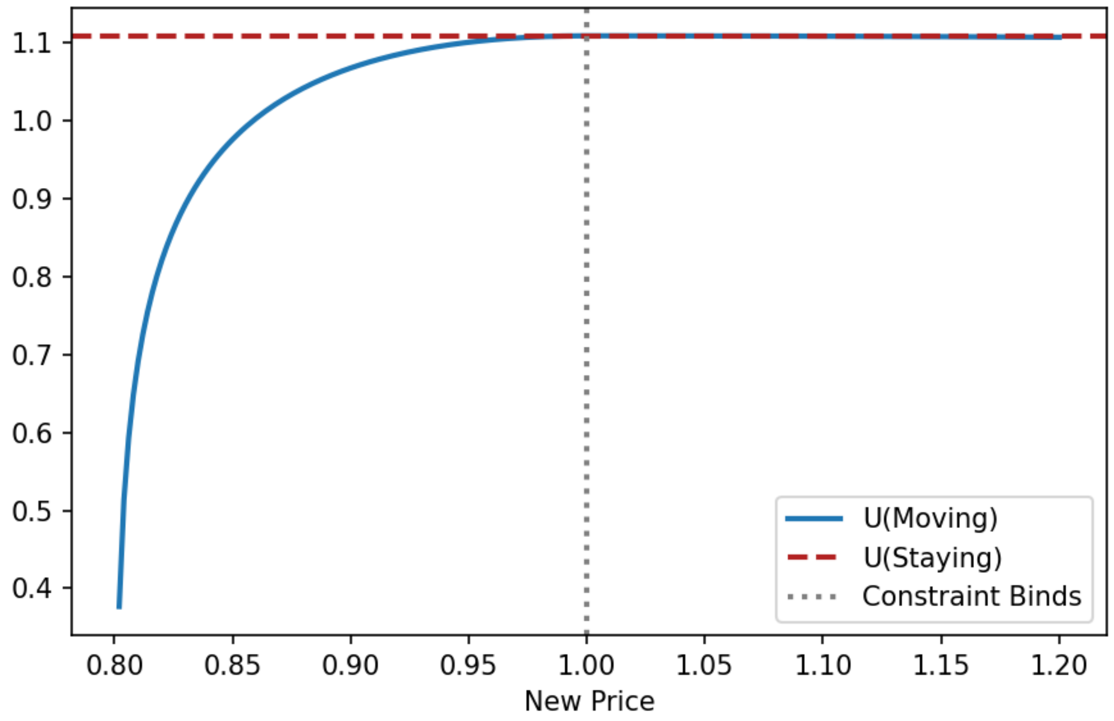
- Now assume you borrow at the beginning of the period on a mortgage and repay at the end of the period (assume interest rate is zero)

  - Minimum down payment (LTV) constraint: $(1-\theta)ph \leq a \rightarrow h \leq \bar{h}$

  - Equilibrium housing choice: $h = \min(h^*, \bar{h})$

Model #1: occasionally binding constraints

- Assume household initially bought a house of size H at price level p
  - Now house price changes from p to $\tilde{p}$
  - Wealth changes from a to $\tilde{a} = a + (\tilde{p} - p)H$
  - If household moves, can reoptimize with $h = \min(h^*(\tilde{p}), \bar{h}(\tilde{p}))$
- Result: **asymmetry**!
  - As price falls, constraint binds, distorting housing purchase
  - Large costs of moving when $\tilde{p} \downarrow$



Model #2: preference for credit

- Households don't need to requalify for their mortgage if they don't move
  - As a result, terms on legacy loan can be unattainable on new loan
- Example: household bought £500k house with £400k mortgage (80% LTV)
  - If house prices fall 20%, house is now worth £400k. LTV is now 100%.
  - Moving to new identical house at 80% LTV would imply **£320k loan**.
  - Household would have to come up with additional **£80k in cash**.
- This effect is also **asymmetric**!
  - If house prices rise 20%, LTV falls to 67%
  - No particular advantage to existing loan vs. new loan

Model #3: multiple constraints

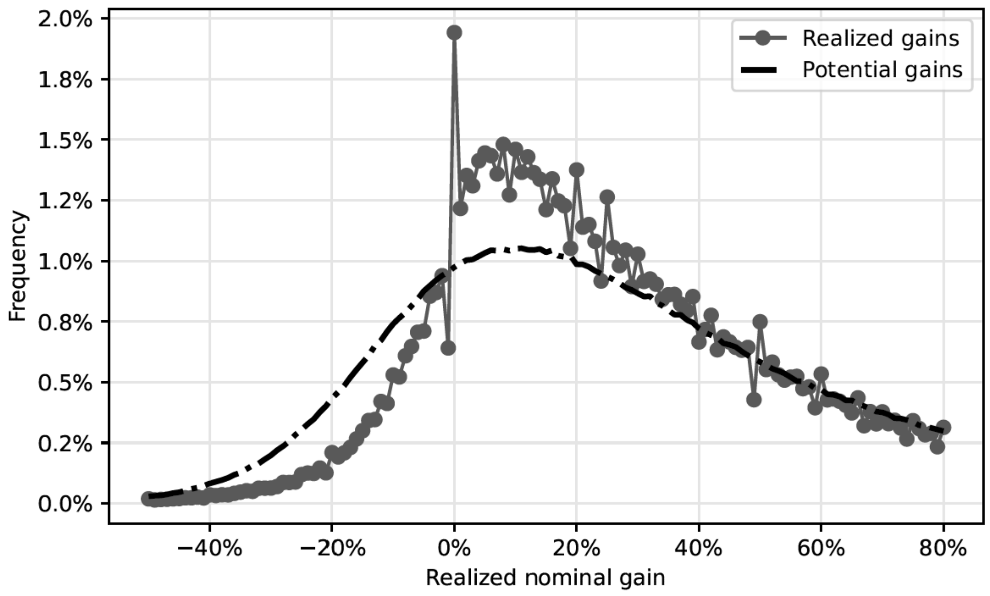
- LTV constraints are typically paired with income-based constraint
  - Either ratio of debt balance or payments to income
- Maximum allowed mortgage size: $\bar{m} = \min\left(\theta p h, \bar{M}(y)\right)$
  - Incentive to choose house size h^* that equalizes these two constraints
  - When $h < h^*$, each £1 of down payment buys θ^{-1} of house (e.g., 5x for 80% LTV)
  - When $h > h^*$, each £1 of down payment buys £1 of house (no more credit)
- Many US households are “jointly constrained” in this way
  - Conjecture: may be true in the UK as well
  - Let’s consider a household for which this holds

Model #3: multiple constraints

- This would **strengthen the asymmetry** from Model #2!
- Assume household bought £500k house with £400k mortgage (80% LTV)
  - This time, we will also assume that $\bar{M}(y) =$ £400k.
- If house prices fall 20%, the maximum loan size on an identical house would now be £320k.
  - Strong incentive not to move
- If house prices rise 20%, the maximum loan size on an identical house would still be £400k.
  - Smaller benefit to moving without larger loan

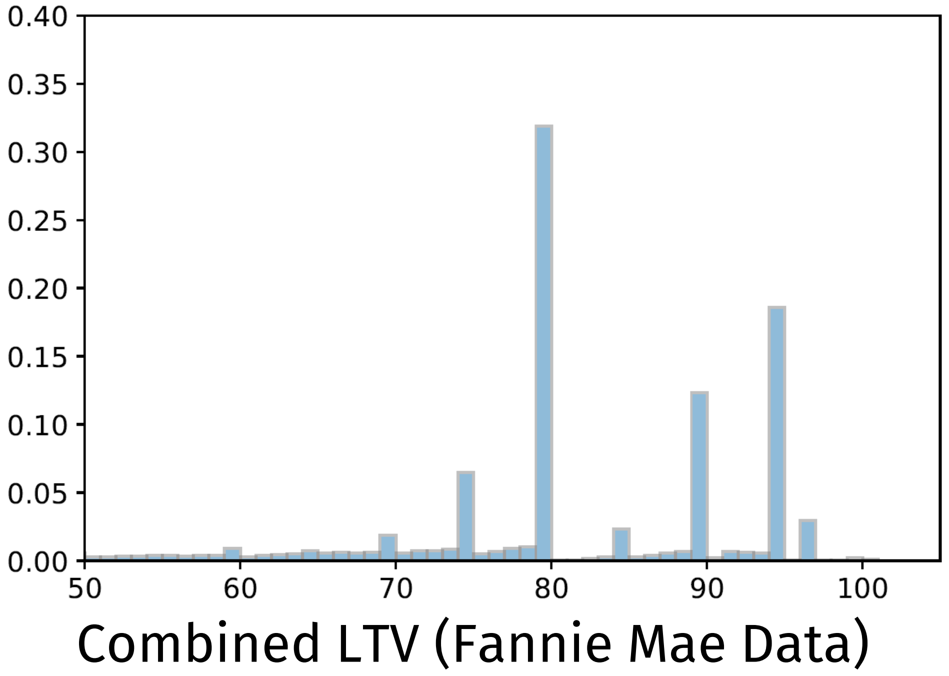
Isolating reference dependence

- Asymmetries from credit would generate similar patterns to those in paper
  - Level of transactions is increasing in house price with decreasing slope
- If asymmetry around previous transacted price can be caused by credit, how can we isolate reference dependence?
  - Bunched mass seems very likely due to reference dependence.
  - What about larger shifts in the distribution?



Isolating reference dependence

- One approach would be to isolate households for which credit constraints are not binding
- This may be challenging, as many households fall at debt limits or jumps in interest rate schedule
  - Plot: US LTV distribution (Fannie Mae)
- Ideally, should also restrict to low-LTV borrowers since higher LTV could still move you to the next price bin



Disentangling these with the structural model?

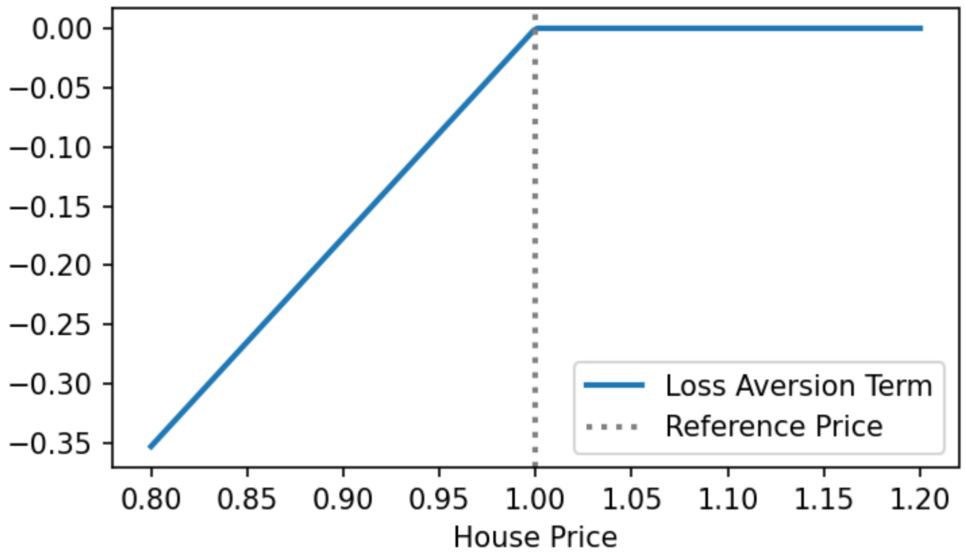
- If the data exercise appears tricky, one nice way to deal with this could be with the structural model
- Indeed, authors currently allow seller utility to include both a reference dependence term and a downsizing penalty (credit effect)

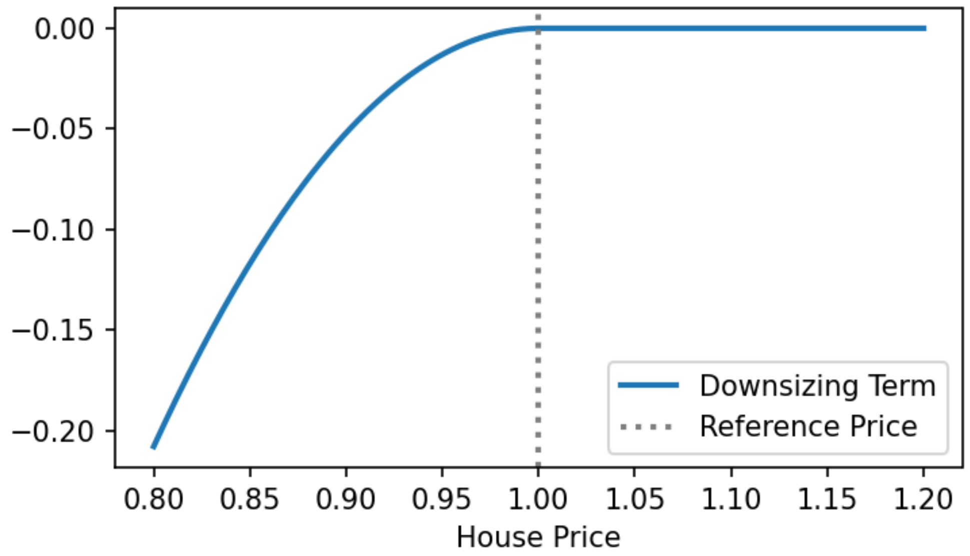
$$U(p_{it}, r_i, m_i) = p_{it} + \underbrace{W(p_{it}, r_i)}_{\substack{\text{Reference}\\ \text{dependence}}} - \underbrace{\mu(\gamma - (p_{it} - m_i))_+^2}_{\substack{\text{Downsizing}\\ \text{penalty}}},$$

$$W(p_{it}, r_i) = \begin{cases} \eta(p_{it} - r_i), & \text{if } p_{it} \geq r_i, \\ \lambda\eta(p_{it} - r_i), & \text{if } p_{it} < r_i. \end{cases}$$

Disentangling these with the structural model?

- Parameters (μ, λ) are estimated to minimize distance from data moments
  - How are they identified? Holding m fixed, from shape (otherwise identical).
  - Loss aversion is piecewise linear, downsizing penalty is piecewise quadratic.
  - Not clear why this should be true, would be great to bring more data to bear (alternatively, need to explain where variation in m comes from)





Conclusion

- Nice paper mixing empirics and structural model to tackle interesting questions about housing market transaction volume
  - Convincing data on level, slope of price/volume relationship
  - Elegant model where distribution of reference prices matters
- A key challenge is separating reference dependence from credit
  - When house prices fall below the purchase price, you are likely unable to qualify for the loan that you used to buy your house
  - “Downgrading” to a smaller loan is an asymmetric cost around reference price
- Would be great to see a cleaner identification of these two effects
  - Although it may not matter for a number of important applications