Housing Market Responses to Transaction Taxes: Evidence From Notches and Stimulus in the UK

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Motivation

- What determines demand and prices in the housing market?
  - Recent debate about the origins of the current financial crisis
- Can fiscal policy stimulate the housing market?
  - Effects of stimulus on real economy?
- Academic work has considered the impact of the cost of homeownership
  - Real interest rates and other credit market conditions: Mian & Sufi 2009; Glaeser et al. 2010; Adelino et al. 2012
  - Tax subsidies to housing: Poterba 1984, 1992; Rosen 1985; Poterba & Sinai 2008
- A policy that has been largely overlooked by academics
  - Transaction taxes on the buying and selling of property
Context and Methodological Advantages

- UK property transaction tax: Stamp Duty Land Tax (SDLT)

- Large administrative dataset:
  - Universe of stamp duty tax returns in the UK from 2004-2012 (about 10 million property transactions)

- Quasi-experimental variation:
  - Tax schedule produces large price notches (discrete jumps in tax liability at cutoff prices)
  - Anticipated tax changes create time notches (discrete jumps in tax liability at cutoff dates)
  - Permanent reforms and stimulus (tax holiday) affect houses in specific price ranges
General finding: transaction taxes create strong distortions in house prices and house purchases

Notches have large effects on house prices

Changes in notches induce fast house price adjustments

Anticipated tax changes have sharp effects on the timing of house purchases

Stimulus (tax holiday) has large effects on house purchases
  ▶ Large boost during stimulus (timing & extensive margin)
  ▶ Smaller slump after stimulus (timing)
  ▶ Translates into substantial effects on real economic activity

Permanent tax reform has strong extensive margin effects
Literature

- Transaction taxes are in general understudied
- Property transaction taxes (Besley et al. 2011; Dachis et al. 2012; Slemrod et al. 2012; Kopczuk & Munroe 2013)
- Taxation of capital gains (Feldstein et al. 1980) and housing capital gains (Cunningham & Engelhardt 2008; Shan 2011)
- Recurring property taxes (Wasi & White 2005; Ferreira 2010; Zodrow 2001)
- Micro studies of stimulus policy (Shapiro and Slemrod 2003; Johnson et al. 2006; Agarwal et al. 2007; Mian & Sufi 2012)
- Taxable income literature and bunching approaches (Saez 2010; Chetty et al. 2011; Kleven & Waseem 2013)
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  Static Notches: House Price Responses
  Moving Notches: Dynamics of House Price Responses
  Stimulus: Timing and Extensive Responses
  Permanent Reform: Extensive Responses

Conclusions
UK Stamp Duty: Notches

- Tax on the total sale price of property; remitted by the buyer

<table>
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<th>Price</th>
<th>Tax Liability</th>
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<tbody>
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<tr>
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Tax Schedule in Tax Year 2012-2013

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\Delta T = £40,000
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## UK Stamp Duty: Reforms & Stimulus

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UK Stamp Duty: Reforms & Stimulus

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**Stimulus: Stamp Duty Holiday 3 Sep 2008 - 31 Dec 2009**

- First notch moved temporarily from £125K to £175K, eliminating taxes in a 50K range
- Beginning of holiday was unanticipated
- End of holiday was anticipated (time notch at New Year 2010)
UK Stamp Duty: Compliance

- HMRC estimates put the stamp duty tax gap between 4-5% (lower than for most other taxes in the UK)

- Evasion through side payments associated with substantial risk
  - Collusion between multiple players difficult to sustain (Kleven, Kreiner, and Saez 2009)
  - Lag between agreeing and completing a house contract further complicates evasion

- Tax base includes “everything” except freestanding “extras” → potential evasion by overvaluing such items
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  Permanent Reform: Extensive Responses

Conclusions
House Price Responses to Notches

Competitive Model vs. Matching Frictions Model

- Transaction tax notch creates **bunching** just below the cutoff and a **hole** above the cutoff in the house price distribution

- **Competitive Model**
  - Bunching driven by real demand (buying lower-quality houses)
  - Bunching does not reflect (market-level) price incidence

- **Matching Frictions Model**
  - Bunching driven by (match-level) price incidence
  - Bunching may also reflect real responses (directed search)

- “House price” responses combine real responses, bargaining and evasion [similar to ETI literature]
Effect of Notch on House Price Distribution

Intensive Responses Only

Density

- Density under linear tax
- Density under notched tax

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Effect of Notch on House Price Distribution

Intensive & Extensive Responses

- Density under linear tax
- Density under notched tax

Extensive Responses

Intensive Responses
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Conclusions
Data

- First-time access to administrative stamp duty records from Her Majesty’s Revenue and Customs (HMRC)

- Universe of stamp duty land tax returns (≈ all transactions) in the UK from 2004-2012

- About 10 million transactions

- Rich tax return information; no information outside the return

- We will soon get compliance data as well
Data Spanning the Collapse of the Housing Market

![Graph showing normalised number of transactions for London and UK from 2005m1 to 2013m1. The graph indicates a significant drop in transactions, particularly in 2008m1, followed by a period of fluctuation before stabilization in 2013m1.]

<table>
<thead>
<tr>
<th>Month</th>
<th>London</th>
<th>UK</th>
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<tbody>
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<td>2013m1</td>
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Prices Have Recovered in London, But Not the UK Overall

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<tr>
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<th>London</th>
<th>UK</th>
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<tbody>
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<td>2013m1</td>
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Conclusions
House Price Responses to £250K Notch, 2004-2012

- $b = 1.85 \ (0.340)$
- $m = 2.21 \ (0.365)$
- $m - b = 0.36 \ (0.694)$
- $h_v = £10,000 \ (1,997.0)$
- $v = 0.08 \ (0.032)$
- Tax = £5,000

Number of Property Transactions

<table>
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<tr>
<th>House Price</th>
<th>Actual Distribution</th>
<th>Counterfactual Distribution</th>
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<tr>
<td>225,000</td>
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<td>250,000</td>
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<td>275,000</td>
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<td>300,000</td>
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<tr>
<td>325,000</td>
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Method
- Conceptual
- Mansions

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House Price Responses to £500K Notch, 2004-2012

\[ b = 1.64 \ (0.510) \]
\[ m = 2.27 \ (0.387) \]
\[ m-b = 0.63 \ (0.855) \]
\[ h_v = £10,000 \ (3,808.7) \]
\[ \text{Tax} = £5,000 \]
\[ v = 0.04 \ (0.031) \]
House Price Responses to £125K Notch, 2006-2008

b = 0.86 (0.144)
m = 0.96 (0.186)
m-b = 0.10 (0.320)
h_v = £5,000 (534.0)

\[ \text{Dhv} = £5,000 \] (534.0)

\[ \text{Tax} = £1,250 \]

\[ v = 0.16 (0.034) \]

Number of Property Transactions

75,000 100,000 125,000 150,000 175,000 200,000

House Price

Actual Distribution

Counterfactual Distribution

Method

Other Periods

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House Price Responses

Summary

- **Bunching and holes:**
  - Large and sharp bunching just below notches
  - Large holes above notches
  - Holes are larger than bunching, consistent with the presence of extensive responses

- **House price responses:**
  - Average house price response $= 2-5 \times \text{tax jump}$
  - Largest house price response (end of hole) $\geq 5 \times \text{tax jump}$
  - Liquidity constraints are likely to play an important role

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Dynamics of House Price Responses
Notch moving from £120,000 to £125,000

4/2005

Number of Property Transactions

House Price

Counterfactual Distribution
Actual Distribution

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Dynamics of House Price Responses

Notch moving from £125,000 to £175,000 and back again

12/2007

\[ b(125) = 0.68 \pm 0.088 \]

\[ b(175) = 0.10 \pm 0.056 \]

Number of Property Transactions

House Value

Counterfactual Density (Red) – Actual Density (Black)

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Dynamics of House Price Responses

Summary

- **Build-up of bunching** when notches are introduced
  - Holiday start (unanticipated): bunching at £175K builds up in 3 months
  - Holiday end (anticipated): bunching at £125K builds up in 1-2 months

- **Disappearance of bunching** when notches are removed
  - Holiday start (unanticipated): bunching at £125K disappears in 4 months
  - Holiday end (anticipated): bunching at £175K disappears immediately

- Little indication of optimization frictions
  - With anticipation, almost zero inertia
  - Without anticipation, small inertia \(\approx\) contract completion lag
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Stimulus: Timing and Extensive Responses

Conceptual Framework

- The stamp duty holiday was an unanticipated stimulus program with a pre-announced end date

- Such stimulus has two conceptual effects on house purchases:
  - **Timing response**: intertemporal substitution by those who would have purchased a house anyway
  - **Extensive response**: house purchases that would not have taken place otherwise

- Key questions:
  - What is the total stimulus effect?
  - How much of it is driven by timing?
  - How quick is reversal?
Empirical Approach

- Difference-in-differences approach

- Naive baseline:
  - Compare treated range 125K-175K to nearby control range
  - Treatment is endogenous to price responses to notches

- Dealing with endogeneity:
  - Widen treated range to include responding ranges on each side (intent-to-treat)
  - Adjust for price responses to notches using bunching estimates
Stimulus: Timing and Extensive Responses

Raw Time Series

Normalised Log Number of Transactions

Month

£125K - £175K

Short Term Timing

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Stimulus: Timing and Extensive Responses

Naive Diff-in-Diff

Short Term Timing

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Stimulus: Timing and Extensive Responses

Diff-in-Diff Adjusting for Bunching Responses

Normalised Log Number of Transactions

Month

£125K - £175K

£175K - £225K

Short Term Timing
Stimulus: Timing and Extensive Responses

Diff-in-Diff Adjusting for Bunching Responses

\[
\begin{align*}
H &= 0.20 \\& (0.022) \\
R &= -0.08 \\& (0.032) \\
P &= -0.00 \\& (0.010)
\end{align*}
\]

-1.25 -1 -0.75 -0.5 -0.25 0 0.25 0.5
Normalised Log Number of Transactions

2007m1 2008m1 2008m9 2010m1 2011m1 2012m1
Month

£125K - £175K £175K - £225K

Short Term Timing
Stimulus: Timing and Extensive Responses

Diff-in-Diff Adjusting for Bunching Responses (Cumulative Effect)

![Graph showing cumulative differences and normalised log for different price ranges (£125K - £175K and £175K - £225K) over months from 2007m1 to 2012m1.]

- Short Term Timing

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### Stimulus: Timing and Extensive Responses

**Reversal / Total Stimulus Effect** *(Sensitivity to Reversal End Date)*

\[-\frac{(12_R)}{(16_H)} = 0.31 (0.124)\]

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<td>2012m7</td>
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Stimulus: Timing and Extensive Responses

Summary

- Housing stimulus increases activity during the 16 months of the program (timing + extensive margin) [20% per month]

- But reduces activity for about 12 months after the program (timing) [8% per month]

- Reversal is less than 50% of stimulus effect
  - Differ from Mian and Sufi (2012) on US car market stimulus

- Why stimulate house purchases during crisis?
  - Homeowner mobility too low during crisis
  - Moving house triggers spending on repairs, renovations, durable goods and commissions → increase in GDP
  - Other housing market spillovers (including house prices)
Immediate Effect of Stimulus on Real Economy

- Lower-bound: stimulus effect only through moving-related spending (not including multiplier effects)
- Using consumption data, we estimate that a house purchase triggers spending of 5% of the house value
- Effect on GDP per dollar of tax cut $\Delta GDP / \Delta Tax \approx 1$
- Work on fiscal stimulus through income tax rebates find smaller effects ($\Delta GDP / \Delta Tax \approx 0.2 - 0.7$)
  - Success of stamp duty holiday relies on (i) strong responsiveness of house purchases to this tax, (ii) strong complementarities between moving house and spending
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Permanent Reform: Extensive Responses

Diff-in-Diff Adjusting for Bunching Responses

P = 0.23 (0.018)

Normalised Log Number of Transactions

2005m1 2005m4 2005m7 2005m10 2006m1

Month

£60K - £120K £120K - £180K

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Permanent Reform: Extensive Responses

Diff-in-Diff Adjusting for Bunching Responses (Cumulative Effect)
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Conclusions
Conclusions

- Property transaction taxes are widely used, but little studied

- We have benefitted from
  - Unique access to complete UK transaction tax records
  - Compelling variation from notches and stimulus

- We have found
  - Large house price responses to transaction taxes
  - Fast price adjustment to transaction tax changes
  - Sharp short-term timing effects to anticipated tax changes
  - Strong stimulus effects without complete reversal
  - Strong extensive responses to permanent tax reform
Appendix

Appendix Slides
Appendix

Estimating the Counterfactual Distribution

Use a flexible polynomial to estimate \( g_0(h_v) \), excluding data around the notch:

\[
c_i = \sum_{j=0}^{q} \beta_j (z_i)^j + \sum_{r \in \mathcal{R}} \eta_r I \left\{ \frac{\bar{h}_v + z_i}{r} \in \mathbb{N} \right\} + \sum_{k=\bar{h}_v^-}^{\bar{h}_v^+} \gamma_k I \{ i = k \} + \mu_i
\]

where \( c_i \) is count of transactions in price bin \( i \), \( q \) is the order of the polynomial, \( z_i \) is the distance between bin \( i \) and the cutoff \( \bar{h}_v \), \( \bar{h}_v^- \) is the lower bound of the excluded range, \( \bar{h}_v^+ \) is the upper bound of the excluded range, \( \mathbb{N} \) is the set of natural numbers, \( \mathcal{R} = \{500, 1000, 5000, 10000, 25000\} \) is a set of round numbers multiples, \( I \{\cdot\} \) is the indicator function, and \( \mu_i \) is the error term.
Appendix
Estimates of the Counterfactual Distribution, Bunching, and Holes

- Estimate of counterfactual distribution:
  \[ \hat{c}_i = \sum_{j=0}^q \hat{\beta}_j (z_i)^j + \sum_{r \in \mathcal{R}} \hat{\eta}_r I \left\{ \frac{\bar{h}_v + z_i}{r} \in \mathbb{N} \right\} \]

- Estimates of excess bunching and hole (missing mass):
  \[ \hat{B}(\bar{h}_v) = \sum_{i=\bar{h}_v^-} (c_i - \hat{c}_i) \quad \text{and} \quad \hat{M}(\bar{h}_v) = \sum_{i>\bar{h}_v} (\hat{c}_i - c_i) \]
Static Price Notches: Bunching and Holes
Notch at £1,000,000; 2011-2012

- \( b = 0.70 \)
- \( v = 0.09 \)
- \( h_v = £30,000 \)
- \( \text{Tax} = £10,000 \)

Graph showing the density of property transactions with actual and counterfactual densities for house prices ranging from £600,000 to £1,600,000. The graph highlights the notches and holes in the data.
Static Price Notches: Bunching and Holes
Notch at £2,000,000; 2012

- $b = 1.26$
- $Dh = £100,000$
- $DTax = £40,000$
- $e_v = 0.13$

<table>
<thead>
<tr>
<th>House Price</th>
<th>Actual Density</th>
<th>Counterfactual Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,400,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,600,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,800,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,000,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,200,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,400,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,600,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- $h_v = £100,000$
- Tax = £40,000
- $e_v = 0.13$
Static Price Notches: Bunching and Holes
Notch at £60,000; 1 Nov 2004 - 16 Mar 2005

\[ b = 0.41 \quad (0.132) \]
\[ m = 0.92 \quad (0.318) \]
\[ m - b = 0.51 \quad (0.446) \]

\[ v = 0.34 \quad (0.200) \]
\[ h_v = £3,500 \quad (1,026.1) \]
\[ \text{Tax} = £600 \]

Number of Property Transactions

<table>
<thead>
<tr>
<th>House Price</th>
<th>Actual Distribution</th>
<th>Counterfactual Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>115,000</td>
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<tr>
<td>140,000</td>
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<td></td>
</tr>
</tbody>
</table>
Static Price Notches: Bunching and Holes
Notch at £120,000; 17 Mar 2005 - 22 Mar 2006

\[ b = 0.70 \ (0.068) \]
\[ m = 0.83 \ (0.226) \]
\[ m-b = 0.13 \ (0.292) \]

\[ D_{hv} = £5,000 \ (282.2) \]

\[ \text{Tax} = £1,200 \]

\[ v = 0.17 \ (0.020) \]
Static Price Notches: Bunching and Holes

Notch at £175,000; 3 Sep 2008 - 31 Dec 2009

\[ b = 1.00 \ (0.270) \]
\[ m = 0.50 \ (0.267) \]
\[ m-b = -0.50 \ (0.520) \]

\[ D_h = £5,000 \ (1,981.8) \]
\[ D_Tax = £1,750 \]
\[ e_v = 0.08 \ (0.065) \]

### House Price Distribution

- **Actual Distribution**
- **Counterfactual Distribution**

<table>
<thead>
<tr>
<th>House Price</th>
<th>Actual Distribution</th>
<th>Counterfactual Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>125,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>175,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>225,000</td>
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<td></td>
</tr>
<tr>
<td>250,000</td>
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</tr>
</tbody>
</table>
Static Price Notches: Bunching and Holes
Notch at £125,000; 1 Jan 2010 - 31 Oct 2012

$\beta = 0.78 \pm 0.121$

$\mu = 0.73 \pm 0.179$

$\mu - \beta = -0.05 \pm 0.288$

$\nu = 0.16 \pm 0.018$

$h_v = £5,000 \pm 274.6$

$\delta\tau = £1,250$

---

**Number of Property Transactions**

- Actual Distribution
- Counterfactual Distribution

---

**House Price**

- 75,000
- 100,000
- 125,000
- 150,000
- 175,000
- 200,000

**Actual Distribution**

- Dotted line

**Counterfactual Distribution**

- Solid line
Time Notch: Short-Term Timing Effects

Difference-in-Bunching with Price Range Counterfactuals

D-i-Bunching = 2.75 (.392)

Week

2009w26 2009w40 2010w1 2010w13 2010w26

Price Range

£75,000 - £125,000

£175,000 - £225,000

£125,000 - £175,000
Time Notch: Short-Term Timing Effects
Difference-in-Bunching with Time Period Counterfactuals

D-i-Bunching = 3.44 (.381)

Week
1 Year Earlier
2 Years Earlier
Actual

Back to Stimulus
Time Notch: Short-Term Timing Effects
Placebo Difference-in-Bunching 1: Price Range Counterfactuals 1 Year Earlier

D-i-Bunching = .09 (.42)
Time Notch: Short-Term Timing Effects

Placebo Difference-in-Bunching 2: Price Range Counterfactuals 2 Years Earlier

D-i-Bunching = -0.03 (0.241)