Frictions and the elasticity of taxable income: evidence from bunching at tax thresholds in the UK

Barra Roantree, Stuart Adam, James Browne, David Phillips

ESRI, April 2016
Introduction

• Large literature seeks to estimate responsiveness of agents to taxes
  – Key determinant of revenues from and efficiency costs of taxation
  – Under certain conditions, elasticity of taxable income (ETI) is a sufficient statistic that measures the excess burden of taxes (Feldstein, 1999)
  – But optimising frictions can attenuate reduced-form estimates of the elasticity of taxable income or labour supply (Chetty, 2012)

• Paper exploits cross-sectional variation created by tax thresholds in the UK to estimate the ETI and magnitude of frictions workers face
  – Increase in tax rate at threshold should create bunching that can use to estimate ETI (Saez, 2010; Kleven & Waseem, 2013)
  – Look at lots of thresholds, in many years, at different earnings levels and across groups to see where and when bunching happens ( & by who)
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a) Bunching at kink-points (increase in marginal rate)
   b) Bunching at notches (increase in average rate)

3. Data

4. Results
   a) Bunching at kink-points
   b) Bunching at notches

5. Conclusions
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a) Bunching at kink-points (increase in marginal rate)
   b) Bunching at notches (increase in average rate)

3. Data

4. Results
   a) Bunching at kink-points
   b) Bunching at notches

5. Conclusions
Thresholds in the UK personal tax system

- **UK has progressive income tax with several bands**
  - Basic, higher & additional rates apply above ‘Personal Allowance’
  - Higher-rate threshold (HRT): rate rises from 20-40% ~£40k
  - Additional-rate threshold: rate rises from 40-50% at £150k
  - Personal Allowance withdrawn from £100k: rate rises from 40-60% at £100k and falls back from 60-40% ~£113k

- **Earnings also subject to National Insurance contributions (NICs)**
  - Nominally paid by both employees and employers
  - Very weak link to benefit entitlement unlike in rest of EU or US
  - Three notches above the LEL from 1986-1998
  - NICs capped at Upper Earnings Limit before 1985 (fall in marginal rate)
  - Kinks at Primary & Secondary Thresholds from 1998 onwards
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a) Bunching at kink-points (increase in marginal rate)
   b) Bunching at notches (increase in average rate)

3. Data

4. Results
   a) Bunching at kink-points
   b) Bunching at notches

5. Conclusions
Bunching at kink points

- Before-tax income $z$
- $k$
- $k + \Delta z$

**Density distribution**

- With smooth tax schedule
- With kinked tax schedule

**Bunching at kink points**
Bunching at kink points

• With smooth distribution of (convex) preferences, people should bunch sharply at thresholds where marginal rate increases
  – Amount of bunching proportional to compensated ETI locally
  – Saez (2010) derived method to estimate the excess (bunching) mass at a kink-point and from this the compensated ETI
  – Should also see dip in distribution where marginal rate falls

• But optimisation frictions mean some individuals won’t/can’t bunch
  – e.g. adjustment costs, hours constraints, inattention,
  – Attenuates estimates of elasticity from bunching at kink-points
  – Fundamental problem that can’t distinguish low ETI from high frictions
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a) Bunching at kink-points (increase in marginal rate)
   b) Bunching at notches (increase in average rate)

3. Data

4. Results
   a) Bunching at kink-points
   b) Bunching at notches

5. Conclusions
Bunching at notches
Notches create dominated region no one should locate in...

1. Bunching below threshold
2. Zero mass in dominated region
3. Gradual convergence back to no-notch density
Bunching at notches
… unless they face substantial frictions

1. Estimate no-notch counterfactual

2. Gives estimate of ratio of observed to counterfactual density in dominated region: Call this $a^* = a(\phi)$

Bunching mass diffuse, not sharp

See some mass in dominated region

© Institute for Fiscal Studies
Bunching at notches

Use estimate of frictions $a^*$ to get unattenuated response $\Delta z$

1. Estimate no-notch counterfactual
   - Assumes $a(\phi)$ locally constant: biases earnings response down

2. Gives estimate of ratio of observed to counterfactual density in dominated region: Call this $a^*=a(\phi)$

3. Scale bunching up by $a^*$

4. ... and back out earnings response of marginal buncher
Bunching at notches
... and so the unattenuated elasticity $\varepsilon$

- Kleven and Waseem (2013) propose two ways to get unattenuated elasticity $\varepsilon$ from this earnings response $\Delta z$

1. ‘Structural approach’
   - Specifying a functional form for utility yields expression that links $\%$ earnings response, $\%$ change in net-of-tax rate, and elasticity
   - Use quasi-linear utility specification: ignores income effects and get mixture of compensated and uncompensated elasticity

2. ‘Reduced-form approach’
   - Use implicit marginal tax rate created by notch between $N$ and $N+\Delta z$
   - … but the notch generates larger earnings response than hypothetical kink, so will overstate the compensated elasticity
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a) Bunching at kink-points (increase in marginal rate)
   b) Bunching at notches (increase in average rate)

3. Data

4. Results
   a) Bunching at kink-points
   b) Bunching at notches

5. Conclusions
Use large admin and employer survey datasets

- **Survey of Personal Incomes (SPI): 2003-2011**
  - Sample of income tax administrative records (~700,000 observations)
  - But doesn’t include non-taxpayers (e.g. those below Personal Allowance)

- **New Earnings Survey (NES): 1978-**
  - Large mandatory employer survey
  - Targets 1% random sample of civilian employees using NI numbers
  - Little measurement error & gives earnings in correct period for NICs
  - But some problems:
    1. Incomplete sample below LEL: we might understate bunching
    2. Earnings reported for period around turn of fiscal year: could face one of two thresholds & means will pick up mixture of responses
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a. Bunching at kink-points (increase in marginal rate)
   b. Bunching at notches (increase in average rate)

3. Data

4. Results
   a. Bunching at kink-points
   b. Bunching at notches

5. Conclusions
Do see bunching at the higher-rate threshold
SPI data from 2003-04 to 2007-08

Note: All figures in 2007–08 prices. Source: 2003–04 to 2007–08 SPI.
… but driven by company owner-managers
SPI data from 2003-04 to 2007-08

Note: All figures in 2007–08 prices. Source: 2003–04 to 2007–08 SPI.
... and implies very small elasticities

<table>
<thead>
<tr>
<th>Kink</th>
<th>All taxpayers</th>
<th>Self-employed</th>
<th>Company owner managers</th>
<th>Other taxpayers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher rate threshold</td>
<td>0.032***</td>
<td>0.058***</td>
<td>0.246***</td>
<td>0.015***</td>
</tr>
<tr>
<td>£100,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>£150,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ** = statistically significant at 5%, *** = statistically significant at 1% level.
Source: Author’s calculations using 2003–04 to 2007–08 Survey of Personal Incomes.
... as does bunching at the 100k threshold

<table>
<thead>
<tr>
<th>Kink</th>
<th>All taxpayers</th>
<th>Self-employed</th>
<th>Company owner managers</th>
<th>Other taxpayers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher rate threshold</td>
<td>0.032***</td>
<td>0.058***</td>
<td>0.246***</td>
<td>0.015***</td>
</tr>
<tr>
<td>£100,000</td>
<td>0.014***</td>
<td>0.020***</td>
<td>0.039***</td>
<td>0.007**</td>
</tr>
<tr>
<td>£150,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ** = statistically significant at 5%, *** = statistically significant at 1% level.
Source: Author’s calculations using 2003–04 to 2007–08 Survey of Personal Incomes.
Table 2

<table>
<thead>
<tr>
<th>Kink</th>
<th>All taxpayers</th>
<th>Self-employed</th>
<th>Company owner managers</th>
<th>Other taxpayers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher rate threshold</td>
<td>0.032***</td>
<td>0.058***</td>
<td>0.246***</td>
<td>0.015***</td>
</tr>
<tr>
<td>£100,000</td>
<td>0.014***</td>
<td>0.020***</td>
<td>0.039***</td>
<td>0.007**</td>
</tr>
<tr>
<td>£150,000</td>
<td>0.022***</td>
<td>0.011</td>
<td>0.070***</td>
<td>0.015***</td>
</tr>
</tbody>
</table>

Note: ** = statistically significant at 5%, *** = statistically significant at 1% level.
Source: Author’s calculations using 2003–04 to 2007–08 Survey of Personal Incomes.
But frictions could explain results at kinks

- Little bunching at income tax kinks, implying small elasticities
  - … even for the self-employed & company owner-managers

- No bunching at kinks in NICs schedule from 1998 where rate rises
  - … nor any dip at thresholds where income tax/NICs rate falls

- Could be that underlying responsiveness small
  - … but estimates seem implausibly small

- Estimates are consistent with larger elasticities if allow for frictions:
  with adjustment cost of 1% net earnings:
  - @100k: all taxpayers estimate of 0.01 could be = 0.49
  - @HRT: company owner-manager estimate of 0.25 could be = 1.58
  - @150k: self-employed estimate of 0.01 could be = 2.35
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a. Bunching at kink-points (increase in marginal rate)
   b. Bunching at notches (increase in average rate)

3. Data

4. Results
   a. Bunching at kink-points
   b. Bunching at notches

5. Conclusions
See some bunching at LEL notch from 1978–85
... sharper bunching between 1986 and 1989
... & sharper again between 1990–99
Implies modest unattenuated elasticities

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduced-form approach</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunching-hole method</td>
<td>0.0965</td>
<td>0.3210</td>
<td>0.6891</td>
</tr>
<tr>
<td><em>s.e.</em></td>
<td>(0.0014)</td>
<td>(0.0046)</td>
<td>(0.0210)</td>
</tr>
<tr>
<td><strong>Structural approach</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunching-hole method</td>
<td>0.0430</td>
<td>0.2221</td>
<td>0.5403</td>
</tr>
<tr>
<td><em>s.e.</em></td>
<td>(0.0009)</td>
<td>(0.0036)</td>
<td>(0.0186)</td>
</tr>
</tbody>
</table>

Note: Bootstrapped standard errors in italics calculated drawing with-replacement from the observed distribution.
Source: Author’s calculations using New Earnings Survey, 1978-1999
Implies modest unattenuated elasticities

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduced-form approach</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunching-hole method</td>
<td>0.0965</td>
<td>0.3210</td>
<td>0.6891</td>
</tr>
<tr>
<td><em>s.e.</em></td>
<td>(0.0014)</td>
<td>(0.0046)</td>
<td>(0.0210)</td>
</tr>
<tr>
<td><strong>Structural approach</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunching-hole method</td>
<td>0.0430</td>
<td>0.2221</td>
<td>0.5403</td>
</tr>
<tr>
<td><em>s.e.</em></td>
<td>(0.0009)</td>
<td>(0.0036)</td>
<td>(0.0186)</td>
</tr>
<tr>
<td><strong>b</strong>: Actual/counterfactual density in bunching region</td>
<td>1.0904</td>
<td>1.1468</td>
<td>1.1493</td>
</tr>
<tr>
<td><strong>a</strong>: Actual/counterfactual density in dominated region</td>
<td>0.8737</td>
<td>0.8257</td>
<td>0.8932</td>
</tr>
</tbody>
</table>

Note: Bootstrapped standard errors in italics calculated drawing with-replacement from the observed distribution.
Source: Author’s calculations using New Earnings Survey, 1978-1999
... but some caveats on these estimates

• Data problems
  – Might understate bunching below threshold
  – Picking up mix of immediate and medium-run responses

• Even with ~1% sample data quite noisy
  – Makes identifying bunching region & estimating counterfactual difficult

• Local estimate for particular group from quite some time ago
  – Low-earning employees in the 1980s & 1990s
Yet clear evidence frictions large for most workers

- Observe large mass in dominated region above LEL:
  - => frictions large enough to prevent most employees relocating just below threshold in where taxes up to 17% of earnings lower

- Complete absence of bunching at notches higher up distribution:
  - locating in dominated region at third notch in 1989 => additional tax wedge of ~£500 on earnings of ~£18k per year (April 2012 prices)
  - Notches at dense part of earnings distribution effecting many workers: e.g. in 1989 at 0.8, 1 and 2 times median earnings

- Also find interesting heterogeneity in frictions faced across groups:
  - At LEL see no missing mass for FT employees => very high frictions
  - But plenty for PT employees => lower frictions (mostly women)
  - Employees in retail/hospitality sector also face lower frictions

© Institute for Fiscal Studies
Outline

1. Thresholds in the UK personal tax system

2. The economics and econometrics of bunching
   a. Bunching at kink-points (increase in marginal rate)
   b. Bunching at notches (increase in average rate)

3. Data

4. Results
   a. Bunching at kink-points
   b. Bunching at notches

5. Conclusions
Conclusions

• Frictions significantly attenuate ETI estimates based on micro data
  – Accounting for these important: can yield much larger ETIs

• Women/PT workers face smaller frictions than Men/FT workers
  – This heterogeneity in frictions corresponds to variation in elasticity estimates documented in wider public/labour economics literature
  – Does the literature estimate differences in preferences or frictions? Important for optimal design of tax policy

• Notches have no place in sensible tax design
  – Highly distortionary & result in large welfare losses, especially for those constrained by employers from reducing hours
  – Irish tax schedule deserving of attention here: PRSI & USC notches