THE TEMPERED ORDERED PROBIT (TOP) MODEL WITH AN APPLICATION TO MONETARY POLICY

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  - explicitly accounts for an (choice) “inflation”
  - is extremely flexible relative to more standard models
  - provides a specification test of more standard *inflated* models
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- And so on...
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  - Governor tables a rate motion; members vote; majority rules; Governor has a casting vote in the event of a split decision
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- Let’s have a look at the raw data...
The Repo-Rate

- Bank of England’s *repo-rate* post-independence →
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![Diagram showing UK Policy Rate, CPI Inflation, RPIX Inflation, CPI Target, and RPIX Target over time.](image-url)
Empirical Approach

<table>
<thead>
<tr>
<th></th>
<th>All members</th>
<th>Insiders</th>
<th>Outsiders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down</td>
<td>0.19</td>
<td>0.14</td>
<td>0.24</td>
</tr>
<tr>
<td>No change</td>
<td>0.67</td>
<td>0.72</td>
<td>0.61</td>
</tr>
<tr>
<td>Up</td>
<td>0.15</td>
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<td>0.16</td>
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Empirical regularity of no-change clearly evident!:

Over 3 bigger than 'up' or 'down'.

Some (raw) evidence of insiders and outsiders acting differently (e.g., outsiders seem to have a bigger preference for tightening...).
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- Regime membership ($q = 0, q = 1$) is unobserved and must be identified on data
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  • Observationally equivalent no-change outcomes, can hence arise from two distinct sources
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  - why? due to uncertainties (and institutional factors); $x_s$ above
Empirical Approach: the TOP model

(a) TOP model

(b) MIOP model

Figure 1: MPC members’ votes modelled as a Tempered Ordered Probit (TOP) model
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- Is no requirement that $\beta_d \equiv \beta_u$; and good reasons to expect not...
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- Overall probabilities of vote choices will be

\[
\Pr(-1) = \Phi(\mu_0 - x_y' \beta_y) \times \Phi(x_s' \beta_d)
\]

\[
Pr(0) = \left[ \Phi(\mu_1 - x_y' \beta_y) - \Phi(\mu_0 - x_y' \beta_y) \right] + \\
\left[ \Phi(\mu_0 - x_y' \beta_y) \times \Phi(-x_s' \beta_d) \right] + \\
\left[ (1 - \Phi(\mu_1 - x_y' \beta_y)) \times \Phi(-x_s' \beta_u) \right] \\
Pr(1) = \left[ 1 - \Phi(\mu_1 - x_y' \beta_y) \right] \times \Phi(x_s' \beta_u)
\]

- Still embodies “excess” of no-change, but in a much more flexible manner (“representing member uncertainty”)

- So here, \( x_j \) can have opposing signs: a tempering effect in one direction and an intensifying effect in the other
A Specification Test for the MIOP

- Interesting empirical issue is whether the down and up propensities are tempered to the same extent.
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• The TOP model can be used as a specification test of the MIOP
  • the implicit test is one of symmetry versus asymmetry in the inertia equations
Variable Selection

- So, we want an explicit role of *uncertainty* in affecting monetary policy decisions (in the tempering equations)
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- In the economic conditions equation: standard Taylor-rule variables
  - inflation and output gap forecasts; $\pi_{Dev,t}$ and $\text{GAP}_t$
Results

- First, estimated; a simple pooled OP; MIOP; and TOP →

- Model selection criteria, all prefer TOP > MIOP > OP.
- Moreover, LR test of TOP vs MIOP is 69, p < 0.001.
- Clearly reject MIOP model in favor of TOP: symmetry doesn't hold.

- Sticking with preferred TOP model, we refine by:
  1. Allow for unobserved heterogeneity in the tempering equations:
     \[
     d_{it} = x_0 d_{it} + \alpha_{id} + \epsilon_{it},
     \]
     \[
     u_{it} = x_0 u_{it} + \alpha_{iu} + \epsilon_{it},
     \]
  2. Allow different members-specific reaction functions: random parameters on the inflation and growth variables:
     \[
     \beta_{\pi i} = \bar{\beta}_{\pi i} + e_{\pi i};
     \]
     \[
     \beta_{GAP i} = \bar{\beta}_{GAP i} + e_{GAP i}.
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- And estimate using simulated ML.
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     \]
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## Results: Panel Effects and Economic Conditions Equation

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Table 1: Interpretation of parameters in the tempered equations

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<td>+</td>
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### Partial Effects: Split by Equation

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<th>No-Change</th>
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- So, recovered RP estimates can tell an interesting story!
Member Specific Parameters: Growth

![Graph showing estimated (random) coefficient for GDP across different researchers.](image-url)
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