Tax Policy and Business Fixed Investment in the United States

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Question and Method

- To what extent does tax policy affect fixed nonresidential investment?

- Build a structural model in which tax policy variables appear
  - Older models infer effect of tax policy variables from “underlying theoretical models”
  - Model has the flavor of q models, but uses underlying determinants of q instead of q itself
  - Will be complex—need to linearize

- Fit using instrumental variables (GMM)

- To what extent have tax policy adjustments been stabilizing?
Basic Idea of Model

- Firm maximizes

\[
\mathbb{E}_t \left\{ \sum_{s=t}^{\infty} (1 + \rho)^{-(s-t)} \left[ \frac{(1 - \tau_s)F_s(K_s)}{1 + r} - gC_s(l_s)l_s(1 - \Gamma_s) \right] \right\}
\]

- Convex cost function \( C(\bullet) \)
- \( r = \) risk free rate, \( \rho = \) required rate of return (risk-adjusted)
- \( g \) is price of investment goods relative to output
- \( k_s \) is real investment credits, \( D_{z-s} \) is depreciation allowance \( z - s \) years into the future per dollar of investment at date \( s \), and

\[
\Gamma_s = k_s + \sum_{z=s}^{\infty} (1 + r)^{-z+s} \tau_z D_{z-s}
\]
Solving the Model

- Extensive derivation deferred to appendix
- Take Euler equation, get 2nd order stochastic difference equation in $K_s$
- Make assumptions
  - Cobb-Douglas production
  - Quadratic adjustment cost
  - Stochastic shocks to production around trend growth $n$
- Linearization yields

$$\frac{I_t}{K_{t-1}} = \left[ \frac{1 - \mu_1}{\alpha} + n + \delta_t \right] - \left( \frac{1 - \mu_1}{\alpha c^*_K} \right) \mathbb{E}_t \sum_{s \geq t} w_{s-t} c_s K_{t-1}^\alpha$$

where $w_{s-t} = (\mu_2 - 1)\mu_2^{-(s-t+1)}$ and $c_s$ is messy expression for “comprehensive user cost of capital” depending on tax policies and productivity $\theta$

**Goal:** estimate three parameters: constant, coefficient, geometric decline of $w$
Data

- $\rho$ calculated from weighted average of bond/stock returns

- $\theta$ is EBIT/net capital stock (with some adjustments)

- Use Auerbach and Hines (1987) to calculate present value of tax benefits, assuming perfect foresight

- Data are from national income accounts
Estimation Strategy

- Separately estimate for equipment and structures

- Instrumental variables (GMM):
  - Time trend
  - 3 lags (starting $t - 2$) of *ex post* cost of capital (with meiopic tax policy considerations)
  - 3 lags (starting $t - 2$) of after-tax cash flow/capital stock

- Standard errors: Newey-West with 4 lags

- **Problem:** Didn’t discuss whether these instruments are appropriate
  - No presentation of first stage
  - No discussion of exclusion restriction
## Selected Results: Equipment

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Capital Coefficient</td>
<td>-0.253</td>
<td>-0.177</td>
<td>-0.144</td>
<td>-0.256</td>
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<tr>
<td></td>
<td>(-5.37)</td>
<td>(-3.89)</td>
<td>(-2.54)</td>
<td>(-4.78)</td>
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<tr>
<td>Cost of Capital Survival Rate</td>
<td>0.583</td>
<td>0.569</td>
<td>0.65*</td>
<td>0.589</td>
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<tr>
<td></td>
<td>(7.04)</td>
<td>(6.07)</td>
<td>(6.52)</td>
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<tr>
<td>Cost of Capital w/o Taxes</td>
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<td>-0.158</td>
<td>–</td>
<td>–</td>
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<tr>
<td></td>
<td></td>
<td>(2.30)</td>
<td></td>
<td></td>
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<tr>
<td>Cost of Capital (meiopic)</td>
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<td>–</td>
<td>-0.077</td>
<td>–</td>
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<tr>
<td></td>
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<td>(-2.75)</td>
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</tr>
<tr>
<td>Net cash flow</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.098</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>(2.98)</td>
</tr>
</tbody>
</table>

- Fits intuition
- Variables not in model have “expected” signs but question model validity
- Structures results much less satisfactory
Stabilization

- Naive idea:
  - Look at fitted values of (aggregate) cost of capital
  - Look at fitted values if we do this with no taxes
  - Compare the variances
  - Taxes slightly increase variance from 0.047 to 0.049

- More sophisticated ideas:
  - What’s the right counterfactual? GE issues
  - These fitted values are measured with error
  - Reverse-causation: policy makers are “fine tuning” their policies to stabilize weighted sum, and so get opposite of stabilization when compared year over year (hopefully addressed via IV)
Conclusion

- Model performs well
- Forward looking cost of capital is a large improvement