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

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

- 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 θ
- **Goal:** estimate three parameters: constant, coefficient, geometric decline of w

Data

- ρ calculated from weighted average of bond/stock returns
- θ 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

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

- 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