

Discussion: “Taxation and Innovation in the 20th Century”
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Summary: Question and Data

- ▶ **Question:** what is the effect of corporate and personal taxes on innovation in the United States?
 - ▶ Micro level: impact on individual inventors and firms
 - ▶ Macro level: impact on US states over time
- ▶ **Data:**
 - ▶ Universe of US inventors including patents and citations
 - ▶ Employment, location and patents of firms active in R&D
 - ▶ Historical data on state-level corporate and personal income tax rates
 - ▶ Period: 1920(40?)-2000

Summary: Empirical Analysis

▶ Regression specifications:

1. State-level regressions: state and year fixed effects, controls for lagged population density, GDP per capita and R&D tax credits
2. Inventor-level regressions: inventor and state \times year fixed effects (exploit differences between tax brackets within a state-year cell) plus inventor controls
3. Location choice model: multinomial logit

▶ Identification strategies (for 1 and 2):

- ▶ OLS
- ▶ IV using predicted marginal tax rate instruments
- ▶ Border-county strategy, exploiting tax variation across neighboring counties in different states

Summary: Results

▶ **Results:**

- ▶ Taxes matter for innovation: higher personal and corporate income taxes negatively affect the quantity (patents), quality (citations), and location (state) of inventive activity at the macro and micro levels
- ▶ Shifting across states accounts for part (but not all) of the effect
- ▶ Weaker effects when there are agglomeration effects, ie. innovation clusters
- ▶ Inventors linked to a corporation respond more strongly to taxes than their non-corporate counterparts

Comments: State-level regressions

- ▶ The effects for patents, citations, # of inventors and superstars are almost identical in several specifications
 - ▶ What is the common factor behind these results?
 - ▶ Implied elasticities between 2 and 4. Are these plausible?
- ▶ Effects of the median income MTR are always larger than the 90th percentile MTR
 - ▶ This seems counterintuitive. What's the rationale?

Comments: State-level regressions

TABLE 3: MACRO EFFECT OF TAXATION (OLS)

	Log Patents (1)	Log Citations (2)	Log Inventors (3)	Log Superstars (4)
90th Pctile Income MTR	-0.041*** (0.005)	-0.040*** (0.005)	-0.040*** (0.004)	-0.047*** (0.007)
Top Corporate MTR	-0.063*** (0.007)	-0.059*** (0.008)	-0.051*** (0.006)	-0.093*** (0.011)
Median Income MTR	-0.045*** (0.005)	-0.046*** (0.005)	-0.046*** (0.004)	-0.060*** (0.006)
Top Corporate MTR	-0.064*** (0.008)	-0.059*** (0.009)	-0.051*** (0.007)	-0.091*** (0.012)
90th Pctile Income ATR	-0.063*** (0.004)	-0.060*** (0.005)	-0.062*** (0.004)	-0.081*** (0.007)
Top Corporate MTR	-0.058*** (0.007)	-0.055*** (0.008)	-0.046*** (0.007)	-0.085*** (0.011)
Median Income ATR	-0.100*** (0.008)	-0.108*** (0.011)	-0.091*** (0.007)	-0.150*** (0.010)
Top Corporate MTR	-0.061*** (0.007)	-0.055*** (0.008)	-0.050*** (0.007)	-0.085*** (0.011)
Observations	2867	2867	2867	2661
Mean of Dep. Var.	7.18	9.87	7.31	4.37
S.D. of Dep. Var.	1.31	1.59	1.33	1.60

Comments: State-level regressions

TABLE 4: MACRO EFFECTS OF TAXES (IV)

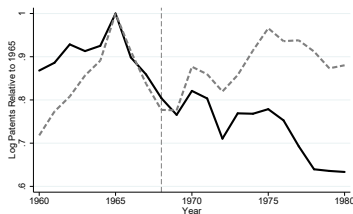
	Log Patents (1)	Log Citations (2)	Log Inventors (3)	Log Superstars (4)
90th Pctile Income MTR	-0.048*** (0.006)	-0.046*** (0.007)	-0.046*** (0.005)	-0.055*** (0.008)
Top Corporate MTR	-0.068*** (0.008)	-0.059*** (0.010)	-0.056*** (0.007)	-0.105*** (0.011)
Median Income MTR	-0.032*** (0.003)	-0.029*** (0.005)	-0.034*** (0.003)	-0.041*** (0.005)
Top Corporate MTR	-0.074*** (0.009)	-0.066*** (0.010)	-0.059*** (0.008)	-0.110*** (0.012)
90th Pctile Income ATR	-0.060*** (0.006)	-0.057*** (0.008)	-0.060*** (0.005)	-0.075*** (0.009)
Top Corporate MTR	-0.063*** (0.008)	-0.055*** (0.010)	-0.050*** (0.007)	-0.098*** (0.012)
Median Income ATR	-0.101*** (0.012)	-0.108*** (0.016)	-0.091*** (0.010)	-0.148*** (0.016)
Top Corporate MTR	-0.066*** (0.009)	-0.055*** (0.010)	-0.055*** (0.007)	-0.097*** (0.012)
Observations	2867	2867	2867	2661
Mean of Dep. Var.	7.18	9.87	7.31	4.37
S.D. of Dep. Var.	1.31	1.59	1.33	1.60

Comments: State-level regressions (cont.)

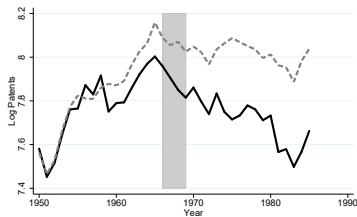
- ▶ Dependent variables (eg, patents) in levels, not per capita terms
 - ▶ Can also try per capita, keeping state population fixed at a given year (eg, 1960)
 - ▶ Controlling for population density essentially equivalent to controlling for population in the FE specification, since state area is fixed
- ▶ Standard errors always clustered at the year level
 - ▶ Why not at the state level?
- ▶ In the IV regressions, how sensitive are the results to values other than $k = 5$?
 - ▶ The standard lag in the ETI literature is $k = 3$

State-level Synthetic Control Evidence

- ▶ Graphical evidence for specific tax reforms in some states using the synthetic control method is not too compelling because pre-reform trends are divergent



Top 3 synthetic control states: CA (1.000), OR (0.000), FL (0.000)



Top 3 synthetic control states: CA (0.514), PA (0.239), TX (0.116)

Timing of the Effects

- ▶ In state- and firm-level regressions, tax variables lagged by one year
 - ▶ Innovation outcomes expected to respond to last year's tax rates
- ▶ In inventor-level regressions, the outcome variable covers 3 years from t through $t + 2$
 - ▶ Captures a medium-term response to tax rate changes
 - ▶ Also lower probability of zero outcomes
- ▶ What is the tax treatment of royalty income?
 - ▶ Relevant in case the inventor licenses patent to others
 - ▶ Royalty income can be earned for many years

The Bigger Picture

- ▶ The main result that taxes reduce incentives for innovation is not entirely surprising
 - ▶ Is it possible to quantify the importance of real responses vs. shifting in this setting?
- ▶ More generally: what is the overall effect of *all* government policies (taxes and subsidies) on innovation?
 - ▶ Large literature on R&D tax credits is complementary to this paper
 - ▶ Future research could try to quantify benefits and costs of govt intervention
 - ▶ Counterfactual to consider: what if the govt raised all revenue through consumption taxes (eg., VAT) without distorting innovation?