Discussion of

Taxation and Innovation in the 20th Century

Ufuk Akcigit, John Grigsby, Tom Nicholas and Stefanie Stantcheva

By Harry Huizinga, Tilburg University

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Innovation of the paper

- This paper examines the impact of taxation on innovation in the US using three novel data sets:

  Inventor-level patent data since 1920

  R&D lab data during 1921-1970

  State-level corporate income tax rate data from 1900

  Assembling these data sets required major effort
- Using these and other data, the authors provide a comprehensive empirical picture of the impact of taxation on innovation at the level of the state, inventor and firm
- Closest paper in the literature using US data:

  Moretti and Wilson (2017) investigate the impact of state taxation on inventor migration flows at the aggregate US state level
- Results show economically meaningful sensitivities of innovation to taxation that can serve as inputs into policy making

My comments

- The model
- The data
- Some aspects of the analysis
- Several extensions using the micro data
- Does the analysis apply to innovation in Europe?

The model

- The paper presents an ‘illustrative toy model’ of innovation by individual inventors and firms
- All margins (effort by the inventor, choice of incorporation, choice between self-employment and working for a firm, etc.) generally reflect personal and corporate taxation
- Model has wage bargaining on a post-corporate tax, but pre-personal income tax basis. This asymmetry implies that a worker could reject some jointly beneficial firm-worker matches. Why not consider bargaining on a completely post-tax basis?
- The terms $h_i(e_i) + m(r_i)$ have been omitted from the expression for the bargained wage w_i paid by the corporation
- The discussion is entirely agnostic about how margins are affected by taxation

The tax data

- The paper uses four state-level personal tax rates:

  Top marginal and average rates for someone at 90th percentile of US income distribution

  Top marginal and average rates for someone with median US income

- IRS data imply following income for US inventors (Bell et al., 2015) :

  Income = 200,000 + 1,400 x citations

- Hence, practically all US inventors are top earners
- The top 10 % for US inventors have average estimated income of $ 716,715 (from calculations in Akcigit, Baslandze, and Stantcheva, 2016)
- Thus, for most US inventors top marginal rate applies
- Question: To which inventors, if any, do the non-top rates used in the paper actually apply?

The tax data
The role of capital gains taxation

- Large share of remuneration of inventor could be the proceeds from selling a patent
- At the US federal level, an individual who sold a patent held for more than one year would be taxed at the lower rates applicable to long-term capital gains (before the Tax Cuts and Jobs Act of 2017)
- Nine states — Arizona, Arkansas, Hawaii, Montana, New Mexico, North Dakota, South Carolina, Vermont, and Wisconsin — tax all long-term capital gains *less* than ordinary income
- Typically, these states allow taxpayers to exclude some or all of their capital gains income from their taxable income, but others levy a lower rate than the state tax on ordinary income
- Omission of capital gains taxation could bias the results regarding taxes on ordinary income

The patent data

- The empirical work uses patent and patent citations data from 1940
- But is a patent in 1940 comparable to a patent in, say, 2010?
- Did laws and regulations governing intellectual property change over time giving rise to different values of patents and patent citations over time?
- Kogan, Pannikolaou, Seru, and Stoffman (2017) use an alternative measure of patent value based on the stock market response to a patent announcement. This measure predicts economic growth better than measures based on raw patent data
- Kelly, Papanikolaou, Seru, and Taddy (2019) use textual analysis of patent texts to estimate how innovative parents are. The resulting measure of innovation predicts future patent citations and aggregate productivity

One key result:

Output of corporate inventors is relatively sensitive to corporate as well as personal taxation

- To understand this result, it would be interesting to see summary stats on how self-employed and corporate inventors differ in, say, age and income levels
- Do results at the state level reflect movements of scientists between the two groups?
- Can the transition between the two groups be modeled with micro data?

Border Counties Strategy to Control for Local Business Conditions

- The authors estimate the differential effect of state taxation on two neighboring counties in different states to control for local business conditions
- Patent data report where inventor lives
- However, inventors may not work where they live, if they live in a border county
- Thus, a lower personal income tax could cause a corporate inventor to move across the state border, without changing the location of the corporate work place
- Alternatively, a lower corporate income tax could cause a corporation to move across state border, without change the home address of the inventor

Possible extension:

Do taxes affect location of patent production or simply patent income shifting ?

- Inventors are interested in low taxation of future as well as existing patents
- Past patents are interpreted as index of future productivity
- However, inventors with lots of patents may be more interested in lowering the taxation of existing patents that in creating new patents
- To control for income shifting, one could distinguish between patents that have expired (i.e., are older than 20 years) and patents that are still valid
- If lower personal taxes primarily attract inventors with valid patents, then inventors mostly act on an income shifting incentive

Another possible extension:
Examine corporate tax effect for domestic vs. multinational firms

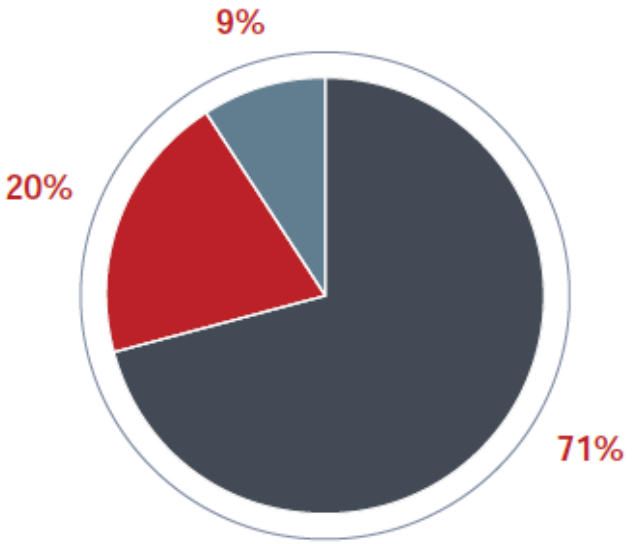
- A higher corporate tax discourages R&D, as patent income is taxed at a higher rate
- However, it could promote R&D employment, as it makes wage deductions more valuable
- For multinational firms, the country where R&D takes place could be different from the country where patent royalties are received
- To control for firm internationalization, one could create a dummy variable reflecting whether a US firm is a multinational with foreign subsidiaries, or alternatively whether a firm is a US subsidiary of a foreign multinational

Smaller points

- The state level regressions are weighted by state population. Does this matter for the results?
- Inventor pre-tax income could vary across states. In the multinomial regressions of mobility, could information on the counterfactual inventor income be added?

Does the analysis apply to innovation in Europe?

In Europe most patents are assigned to corporations



	2018
Large enterprises	71%
SMEs[2], individual inventors	20%
Universities and public research organisations[3]	9%

Source: European Patent Office Annual Report, 2018

Dominance of corporations could reflect difficulty of obtaining patent protection in Europe.
In Europe, a patent granted by the EPO is not directly applicable in individual countries, but instead subject to a complicated and costly process of ensuring validity in individual member states.
Solution: Unitary patent in Europe.

In Europe, country of patent application may not be country of R&D

Table: European patent applications per million inhabitants

Source: EPO Annual Report 2018

Rank	Country	Applications per mio inhabitants	Population[3] (mio inhabitants)	Applications[1]
1.	Switzerland	955.9	8.293	7 927
2.	Netherlands	416.3	17.151	7 140
3.	Denmark	411.4	5.810	2 390
4.	Sweden	403.3	10.041	4 050
5.	Germany	332.3	80.458	26 734
6.	Finland	312.1	5.537	1 728
7.	Austria	260.7	8.793	2 292
8.	Belgium	204.0	11.571	2 360
9.	Japan	179.2	126.168	22 615
10.	Israel	172.8	8.425	1 456
11.	Ireland	158.0	5.068	801
12.	France	153.2	67.364	10 317
13.	Korea, Republic of	141.9	51.418	7 296
14.	United States	132.5	329.256	43 612
15.	Norway	113.5	5.372	610
16.	Puerto Rico	110.8	3.295	365
17.	United Kingdom	88.1	65.105	5 736
18.	Singapore	87.2	5.996	523
19.	Chinese Taipei	75.0	23.546	1 767
20.	Italy	70.7	62.247	4 399

Conclusion

- This is a very nice paper from which we learn a lot about taxation and innovation!