How the Closing of America's Borders Affected Innovation: Evidence from the 1920s

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Highly Skilled Immigration or . . . Simply Immigration

- We're used to thinking about highly skilled immigration as a potential source of long-term economic growth.
- Two pathways:
  1. highly skilled immigrants may innovate themselves, increasing the productivity of those affected by their innovations.
  2. highly skilled immigrants may share tacit knowledge with those around them, causing those around them to innovate.
- The latter effect most clearly suggests the possibility of a virtuous cycle of innovations leading to long-term growth.

Highly Skilled Immigration or . . . Simply Immigration

- But the tendency of immigrants to cause those around them to innovate is not necessarily limited to innovative (high skilled) immigrants
- Low and medium skilled immigrants could also affect the innovative potential of those around them.
- For example, Pan and Cortes (2017) show that low skilled immigrants free high skilled women to spend more time working outside the home.

Channels through which Immigration may affect Innovation of natives

- Positive:
  - Substitute for native workers in non-innovative tasks, pushing natives to innovate
  - Spur economic growth, thus relaxing constraints on (and increasing incentives for) innovation
  - Share tacit knowledge with native workers, spurring innovation
- Negative:
  - Substitute for native workers in innovative tasks, creating crowd-out
  - Compete with native workers for scarce resources necessary for innovation
  - Shift government spending/attention to remedial education/housing issues

How to test whether the relationship is positive or negative

- We need an event which changed immigration rates
- We need the change in immigration to last an extended time
- We need the change in immigration to vary across locations
- We need many such locations, for sufficient statistical power
- We need there to be innovators or potential innovators in each of these locations
- We need to be able to measure innovation outcomes of individuals living in these locations over an extended period of time

How we test this relationship

- In this paper, we consider the closing of the United States' borders in the early 1920s.
- Before 1921, the United States had nearly open borders with Europe.
- By 1921, many people of Western European background became worried about the increasing portion of new immigrants from Southern and Eastern Europe.
- In 1921, and again in 1924, the United States enacted country-specific immigration quotas that targeted immigration from countries such as Italy and Russia, but not Great Britain or Norway.

Potential Strategy

- Some U.S. cities depended on immigrants from Southern and Eastern Europe.
- Other U.S. cities depended on immigrants from Western and Northern Europe.
- By comparing inventors in both groups of U.S. cities with each other over time, we can see how inventors who experienced a large decrease in overall immigration to their city compared to otherwise similar inventors living in otherwise similar cities that did not experience a large decrease in overall immigration.

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- We recently found out that Ager and Hanson (October 2017) and Abramitzky and Boustan (forthcoming) are a few months ahead of us on this identical strategy, but they are using it to study other economic effects of immigration (not innovation).

Different cities attracted different immigrants

- Boston, MA had a total population in 1920 of about 650,000 people, of which about 35% were foreign born.
- Cleveland, OH had a total population in 1920 of about 560,000 people, of which about 35% were foreign born.
- But Cleveland was about twice as likely as Boston to have immigrants who were from countries targeted in the quota.

Compare Innovators in Different Cities

- We create synthetic controls for each of the 273 cities with high exposure to the quotas, choosing cities with similar pre-quota immigration levels, total populations, and patents per person. The synthetic controls are intentionally dissimilar in one important way: they have immigrants from non-quota-affected source countries.
- We then compare people living in highly exposed cities to those in the synthetic controls before and after the shock. We consider outcomes such as patents per year, citations per year, as well as lifetime patents for those who experienced the shock as children.

History of Quotas

- Representative Ira Hersey of Maine: "We have thrown open wide our gates and through them have come other alien races, of alien blood, from Asia and southern Europe . . . with their strange and pagan rites, their babble of tongues."
- Senator Earl Michener of Michigan: "The Nordic People laid the foundations of society in America. They have builded this Republic, and nothing would be more unfair to them and their descendants than to turn over this Government and this land to those who had so little part in making us what we are"
- Senator Reed of Pennsylvania: "maintain the racial preponderance of the basic strain on our people and thereby to stabilize the ethnic composition of the population."
- Opposed to ethnic organizations such as the Sons of Italy



History of Quotas

- 1921: annual quota of each nationality at 3% of the number of foreign-born persons of such nationality resident in the US in 1910
- 1924: annual quota of each nationality at 2% of the number of foreign-born persons of such nationality resident in the US in 1890



Annual Size of the 1924 Quota, by country

Northwest Europe and Scandinavia		Eastern and Southern Europe		Other Countries	
Germany	51,227	Poland	5,982	Africa	1,100
UK	34,007	Italy	3,845	Armenia	124
Ireland	28,567	Czechoslovakia	3,073	Australia	121
Sweden	9,561	Russia	2,248	Palestine	100
Norway	6,453	Yugoslavia	671	Syria	100
France	3,954	Romania	603	Turkey	100
Denmark	2,789	Portugal	503	Egypt	100
Total (Number)	142,483	Total (Number)	18,439	Total (Number)	3,745
Total (%)	86.50%	Total (%)	11.20%	Total (%)	2.30%

New Immigration from Italy in 1921 = 222,260

Quota for Italy after 1921 = 40,294

Quota for Italy after 1924 = 3,845

New Immigration from Scandanavia in 1921 = 22,854

Quota for Scandanavia after 1921 = 41,412

Quota for Scandanavia after 1924 = 18,665

Data

- We identify who is living where in 1919 through the complete count 1920 US Census with names.
- We identify inventors of all US patents from 1899 to the present through the EPO's PATSTAT database.
- We make use of a merge between the 1920 US census and the PATSTAT database at the individual name level from Doran (2018).

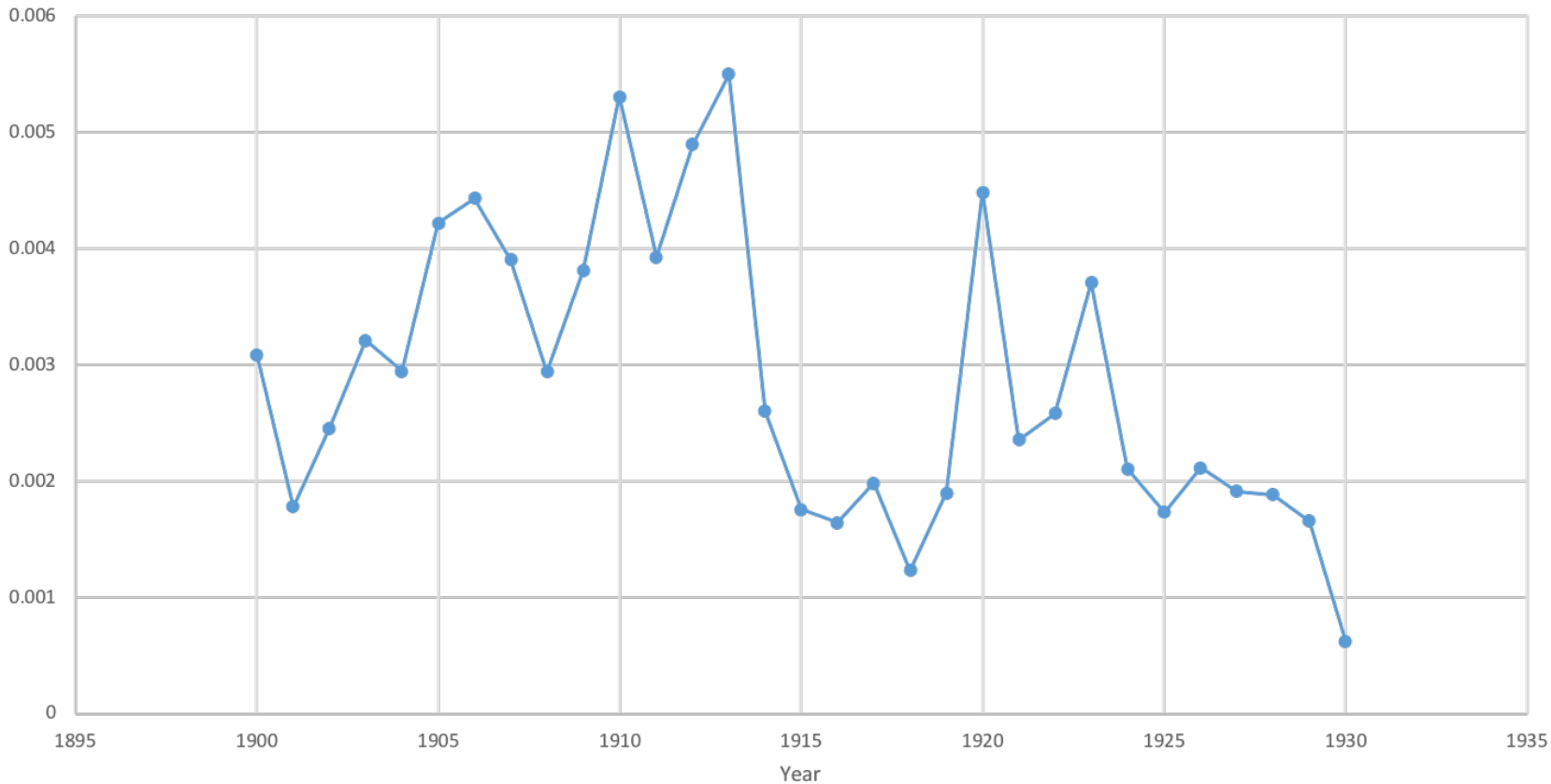
Merging Patents into the Census

- In Doran (2018), I use a fuzzy matching procedure to merge patents and publications at the individual-name level into the 1900, 1910, 1920, 1930, and 1940 US Censuses.
- Idea: each US Census tells us how many people living in the US at that time had your unique first name, middle name, and last name combination.
- Almost half of the population is made up of people who are the only person in the country with their first name, middle name, and last name combination.

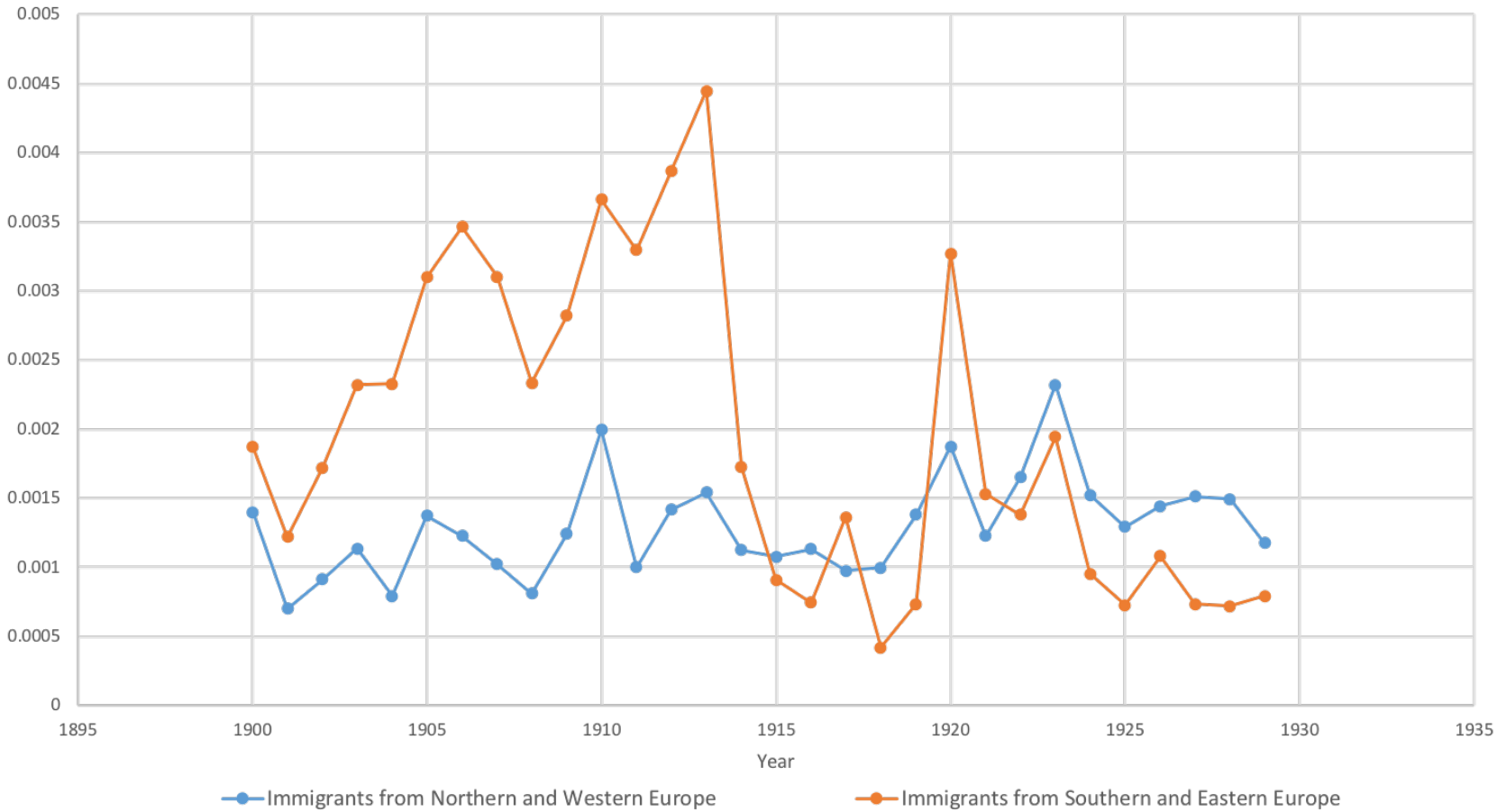
Merging Patents into the Census

- Names restriction: 43% of US population made up of people with unique names in 1920 Census
- Years restriction: patents by these people btwn ages of 18 and 80
- How plausible is the merge?
  - If you have a unique name in the 1920 Census (observed in 1919), then any patents applied in the years 1919 through 1929 with your unique name must either be from you, or from someone who immigrated to the United States with your unique name during those years. They could not be from someone born after 1919 with your unique name, because any such person would be younger than 10 years old. They could not be from someone born before 1919 who died by 1919, because such a person would be dead.

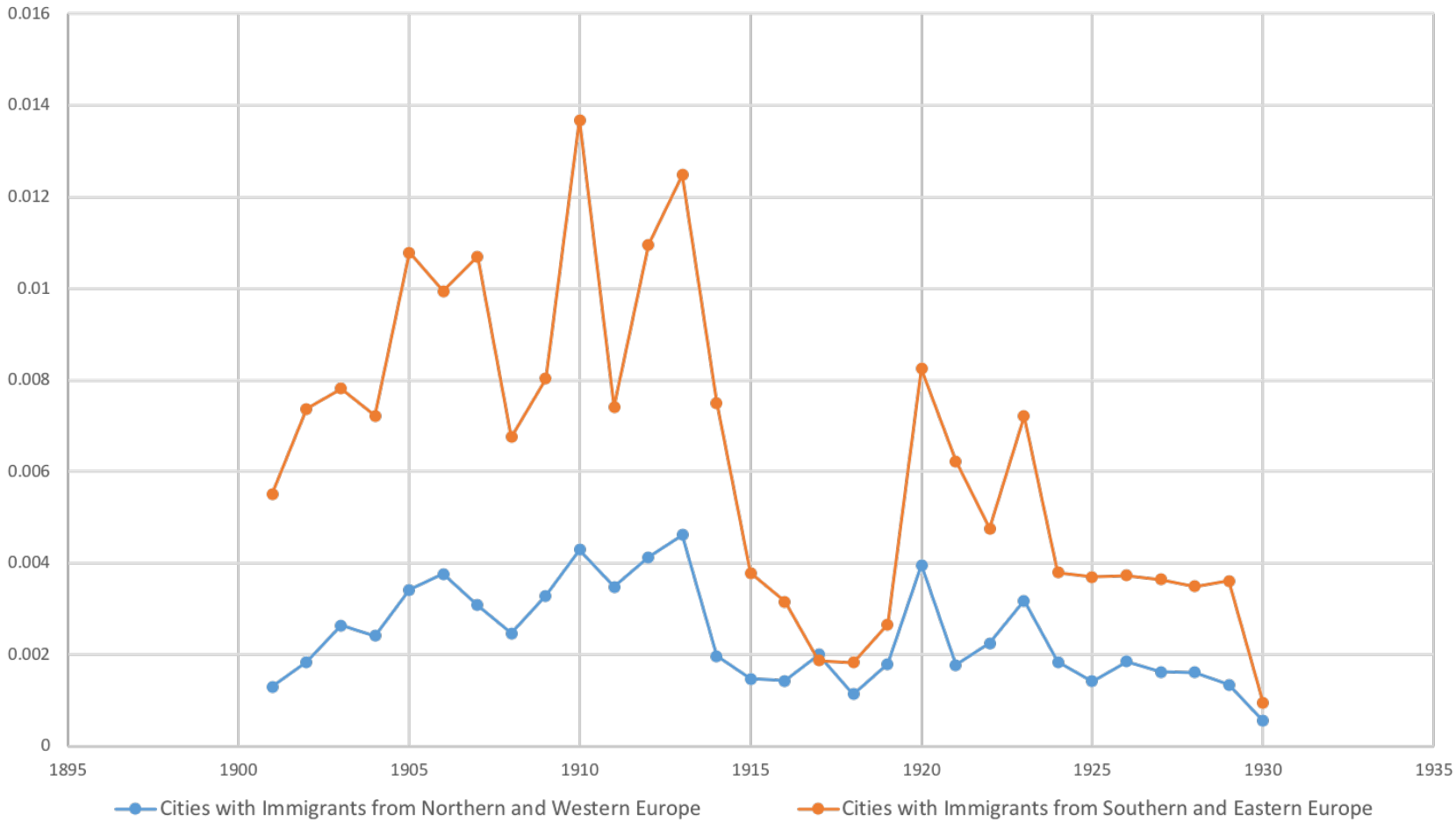
New Immigrants to the United States per year as a fraction of 1910 U.S. population



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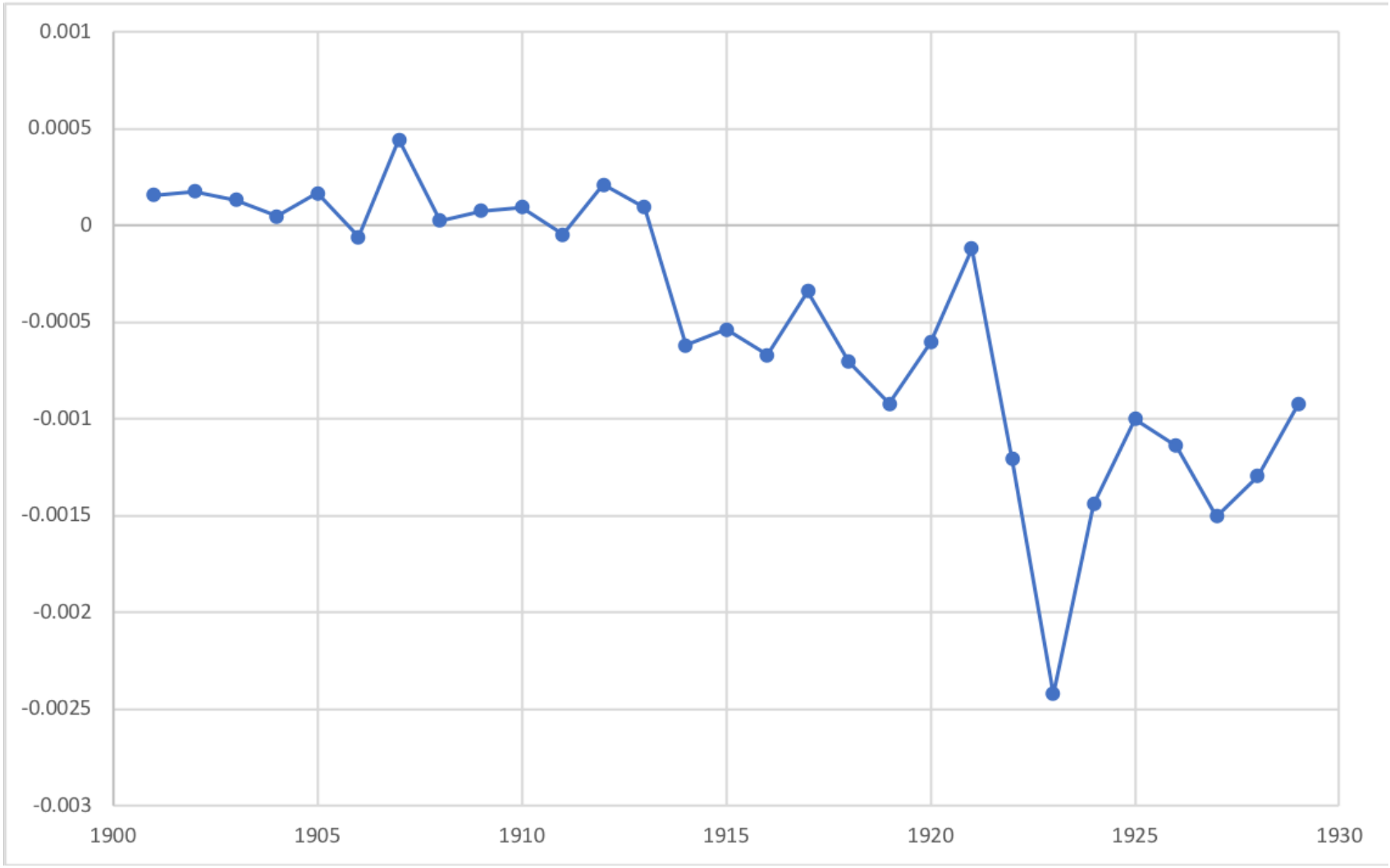
Treated cities

- There are 3,678 cities in our data. We choose as our treated cities the 273 cities with the highest quota exposure.
- Quota exposure = number of immigrants living in the city in 1920 who report immigrating from quota-restricted countries between the years 1910 and 1914, divided by that city's 1910 population.

Synthetic Control Method

- We use the synthetic control method of Abadie, Diamond, and Hainmueller (2010).
- It provides a data-driven procedure to construct synthetic control units based on a convex combination of comparison units that approximates the characteristics of the unit that is exposed to the intervention.
- Donor pool of potential synthetic control cities: 2,932
- We match cities on: (1) total population in 1910; (2) foreign born population 1910; (3) average patents per year between 1915 and 1921; and (4) the number of immigrants with arrival years 1905, 1910, 1913, 1917, and 1921 as a fraction of the city's 1910 total population.

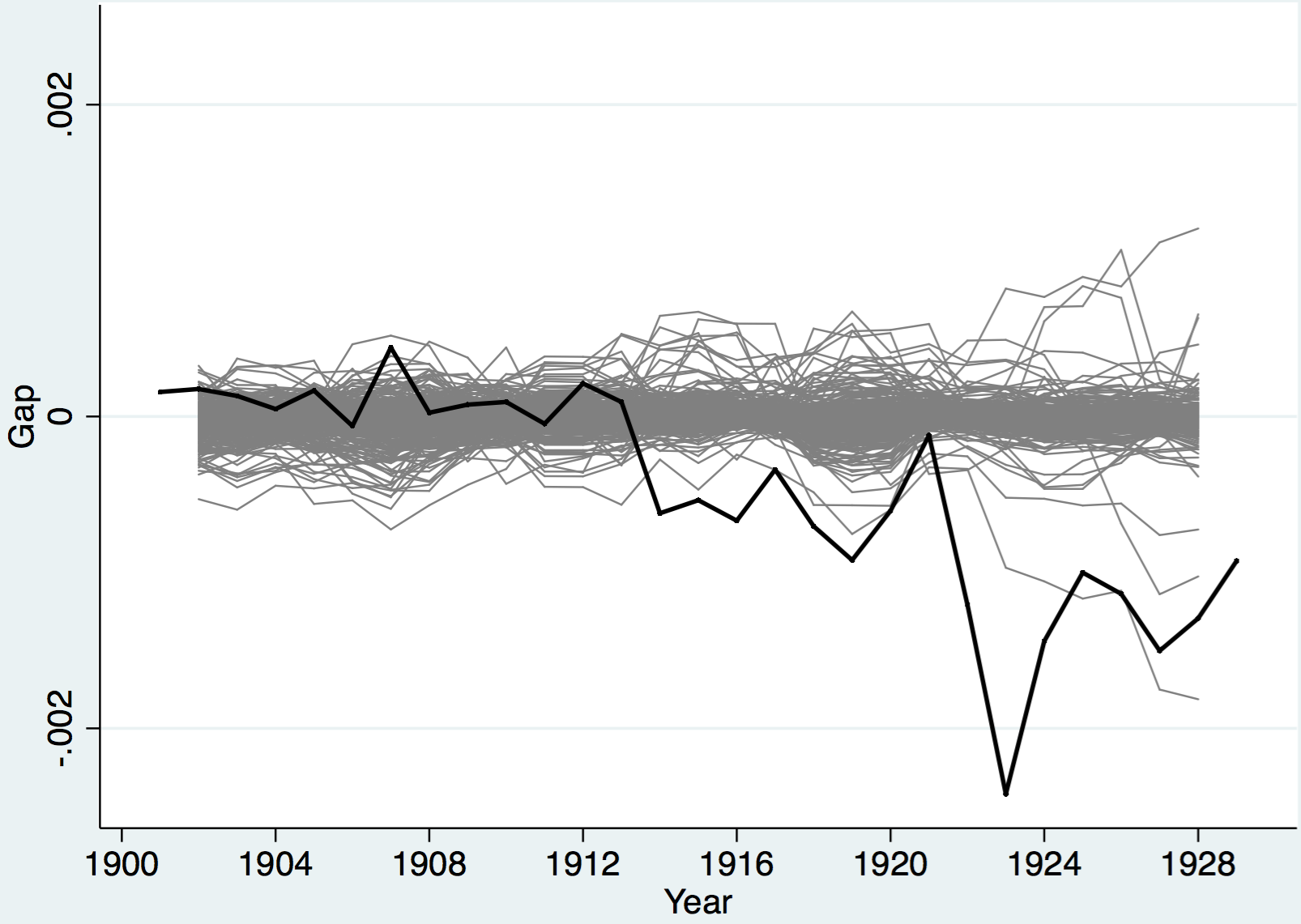
New Immigrants to the U.S. per year as a fraction of 1910 U.S. population
The average of GAPS between highly exposed cities and synthetic cities.



How unusual is it for otherwise similar cities to diverge after 1921?

- Do otherwise similar cities with immigrants from the same source countries also have diverging immigration rates after 1921?
- We consider 524 placebo treatment cities between the 10 and 25 percentiles of quota-exposure.
- We use the same synthetic control method to pick synthetic control cities for these placebo treatment cities.
- Placebo treatment cities do not vary from their control cities much compared to the actually treated cities from their control cities.

New Immigrants to the U.S. per year as a fraction of 1910 U.S. population
GAPS between placebo cities and synthetic cities.



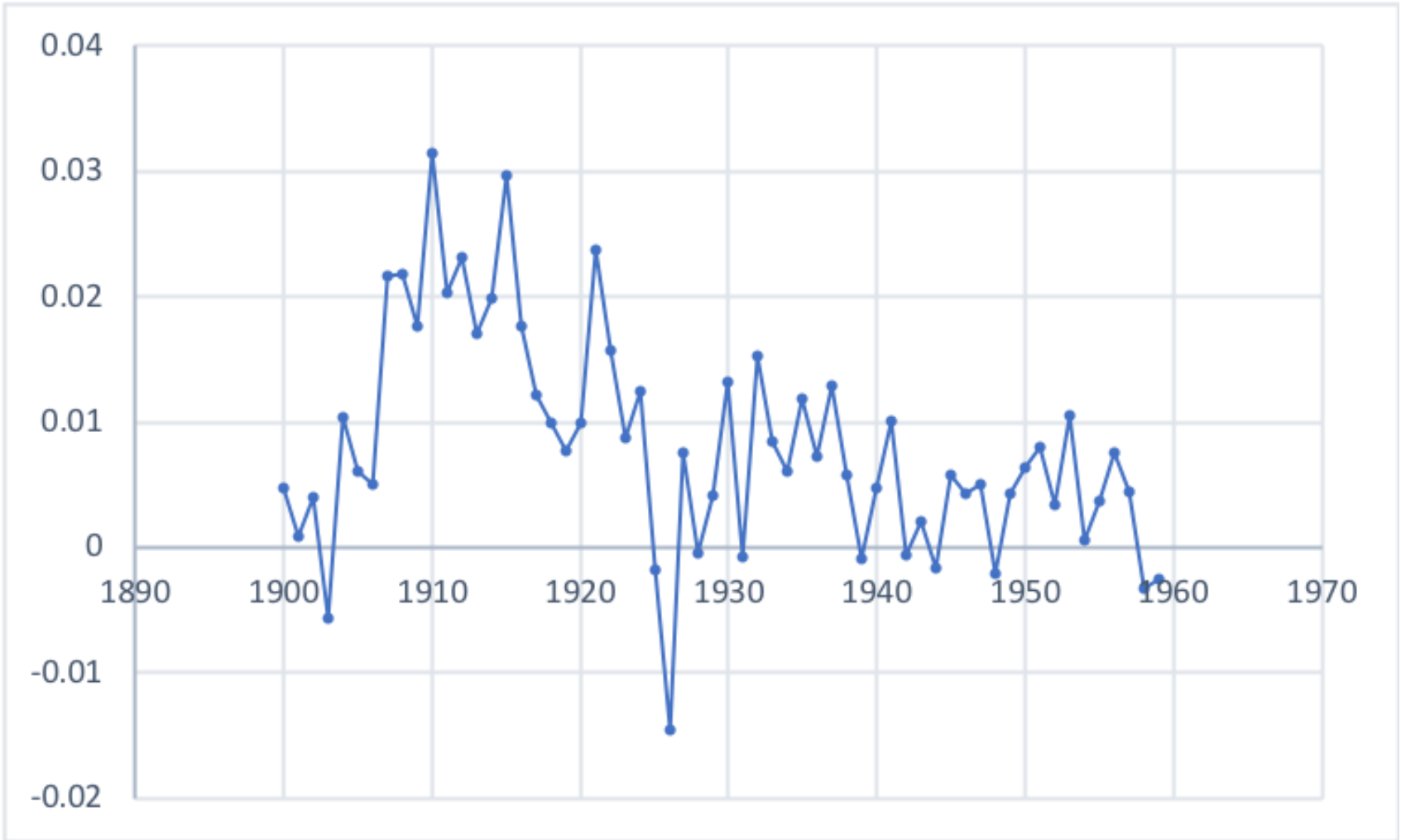
How did people living in these cities respond?

- We consider people living in treated and control cities in 1919 (observed in 1920 US Census).
- First sample of interest: people who have already completed at least one patent by the year 1919 (pre-existing inventors).
- We need to weight each inventor in each treated city and each control city by the right amount using the city-level weights produced by the synthetic control method.
- $weight_j = \sum_c \frac{w_j^c}{p_j} \cdot \frac{p_c}{\sum_c p}$

  where $j \in$ control city, $c \in$ treatment city

  w_j^c: weight, p: the number of individuals given a city

Gap in the Number of Patents per year between highly exposed cities and synthetic cities.



Difference-in-Differences Specifications

- We estimate regressions of the following form:

$$Y_{ict} = \alpha + \beta(Quota_c \times Post_t) + X_{it} + \tau_t + \gamma_i + \epsilon_{ict}$$

- Y_{ict}: The number of patents or citations of person i in year t
- $Quota_c$: Quota exposure of city c
- $Post_t$: 1 if year $\geq$ 1924, 0 otherwise
- X_{it}: Quartic of age of person i in year t
- Standard errors are clustered at the city level.

Difference-in-Differences Results

People with at least one patent by 1919

	Patent		Citation	
	(1)	(2)	(3)	(4)
Coefficient	-.061***	-.071***	-.123***	-.154**
	(.014)	(.024)	(.044)	(.067)
Weight		×		×
N	1,550,670	1,200,349	1,550,670	1,200,349

Difference-in-Differences Results

People with at least one patent by 1910

	Patent		Citation	
	(1)	(2)	(3)	(4)
Coefficient	-.066***	-.109***	-.135***	-.215**
	(.018)	(.033)	(.059)	(.108)
Weight		×		×
N	859,561	662,045	859,561	662,045

Conclusions so Far

- Pre-existing inventors completed 3.8% fewer patents per year for every 100 fewer immigrants entering their city that year.

Next Steps

- What about the extensive margin? Does more years of exposure to unexpectedly low immigration levels reduce one's probability of *becoming* an inventor?
- What kinds of inventions were not produced? Does immigration impact some areas in the space of ideas more than others?
- What mechanisms are causing the effect?