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ABSTRACT

The Effects of Immigration Quotas on Wages, the Great Black Migration, and Industrial Development*

This paper exploits the exogenous and differential immigrant supply shocks caused by the immigration quota system in the 1920s to identify the causal effects of the immigration restriction on the US manufacturing wages, the Great Migration, and industrial production between 1920 and 1930. I find that the immigration restriction significantly increased manufacturing wages and encouraged the southern black population to migrate to the North. I also find that the decline in the immigrant supply constrained the growth of the scale of manufacturing production and discouraged technology adoption of electrification.

JEL Classification: J61, K37, N32

Keywords: immigration restriction, Great Black Migration, industrial development

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* I am indebted to Jennifer Hunt for her continued guidance and support. I am grateful to Ira Gang and Anne Piehl for insightful discussions that greatly improved this paper. I am also thank Bill Collins, Zhutong Gu, John Landon-Lane, Ethan Jiang, Reka Juhasz, James Kung, Chris Minns, Carolyn Moehling, Hillel Rapoport, Scott Rozelle, Chen Ting, Marianne Wanamaker, Shuyang Yang, and seminar participants at the RGS/RWI Workshop on the Economics of Migration, Rutgers, Stanford REAP, LSE Economic History, EEA Annual Conference, CES NA Conference, IZA Annual Migration Meeting, World Congress of Cliometrics, and International Quantitative History Symposium, HED Workshop for valuable comments. I thank Ryan Womack for help with the data. The majority of the work was done when I was a PhD candidate in the Department of Economics, Rutgers University. All remaining errors are my own.

"Three quarters of a century ago, as to-day, the only good immigrants were the dead immigrants."

"The only real difference between the old immigration and the new is that of numbers....The true reason why the "old immigration" is preferred is that there is very much less of it."

— Isaac A. Hourwich, *Immigration and Labor (1912)*

1 Introduction

Studies show that immigrants have substantial gains from migration (McKenzie et al., 2010; Abramitzky et al., 2012, etc.) and benefit the receiving economy in various ways (Cortes, 2008; Hunt and Gauthier-Loiselle, 2010; Peri, 2012; Nunn et al., 2017, etc.). Nonetheless, there can be a distributional effect that hurts native workers so the impact of immigrants on natives' labor market outcomes has been a major concern of natives throughout history, affecting their attitudes towards immigrants and immigration policy formation (Goldin, 1994; Timmer and Williamson, 1998). Despite much research, economists have not settled the long-standing debate (see reviews by Friedberg and Hunt, 1995; Lewis and Peri, 2015; Blau and Mackie, 2016).[1] Existing identification strategies have not convincingly resolved the endogeneity problem that immigrants tend to settle in areas with high or growing wages. Moreover, there are various aspects of the impact of immigration yet to be fully explored. The impact of immigration on the internal migration of natives (Card, 2001; Kritz and Gurak, 2001; Borjas, 2006; Peri, 2007, etc.) is less well understood and the evidence is mixed. In addition, there is limited evidence on how immigration affects adjustments in production and technology adoption (Lewis, 2013; Clemens et al., 2017).

This study contributes by developing a new identification strategy that exploits the variation of the immigrant supply shocks caused by the US immigration quota system established in the 1920s. Using micro-samples of the Censuses of Population from IPUMS and digitized statistics from the Censuses of Manufactures, this study also adds to the literature by comprehensively examining the causal impact of the immigration restriction on manufacturing wages,

[1] In the National Academies Report (Blau and Mackie, 2016), the community manages to reach consensus that immigrants have a weak wage effect on average native workers but controversies remain, in particular regarding their impact on low-skilled natives.

the internal migration of blacks, adjustments in industrial production, including establishment size, capital and skill intensities, labor productivity, and technology adoption of electrification in the manufacturing sector.

Beginning in the 20th century, the US made significant legislative efforts to restrict immigration. A stringent country-based quota system was established in 1921 and became permanent in 1924 that set annual quotas for immigrants from each country in Europe, Africa, Oceania, and Asia.[2] The quotas caused exogenous and differential shocks to the immigrant labor supply across the US: because the quotas assigned to Southern and Eastern Europe were much smaller compared to those assigned to other European countries, they reduced the immigrant supply to a region more significantly if the region historically had received more Southern and Eastern European immigrants.

To quantify the immigration policy shocks, I estimate the number of immigrants "excluded" from each US region (county and state) by the quota system. I first project the "no-quota" counterfactual immigrant inflow from each European country to calculate the difference between the counterfactual and the quota from 1922 to 1929 as the number of excluded immigrants in this decade. I then apportion excluded immigrants to each US region based on the historical settlement pattern of immigrants by each country. The total number of immigrants excluded from a region (scaled by the region's labor force size) serves as the instrumental variable for the change in the foreign-born share in this region between 1920 and 1930. The time frame of the analysis is limited to 1920-1930 because the Great Depression severely discouraged immigration and most countries' quotas were not exhausted in the 1930s, which weakens the power of the instrument.

Card (2001) uses a shift-share instrument for immigration in the 1990s by redistributing the total immigrant inflow to each region based on immigrants' past settlement pattern. Presumably the imputed regional immigrant inflow is determined by push factors and ethnic links to predecessors that are not correlated with the regional economic conditions. However the immigrant inflow at the national level can be "pulled" by a booming regional labor market (Cortes and Pan, 2014). Ruist et al. (2017) point out that the shift-share instrument may produce biased

[2]African and Oceanian countries' quotas and immigrant inflows were trivial compared to Europe's. Most Asian immigrants had already been excluded by the Chinese Exclusion Act of 1882 and the Literacy Act of 1917.

estimates because the serial correlation of immigrant inflows lead to the conflation of short-run and long-run effects. The identification strategy in this study improves on the shift-share instrument by using the ethnic-enclave feature of immigrants in conjunction with a regime shift that exogenously affects immigrant inflows.[3]

Besides the innovation of identification, this study is the first to examine the impact of the immigration quota system on wages.[4] It improves the understanding of the impact of immigration restrictions on the labor market and contributes to the relatively small historical literature on the immigrant wage impact, where historical evidence is mixed. Ferrie (1996) finds a limited effect of immigration on natives' wages in the antebellum period. Goldin (1994) uses panel data of city-level wages during 1890-1913 and Hatton and Williamson (1995) analyzes the time series of national wage data from 1870 to 1913. Both find a strongly negative impact of immigrants on wages. Concerning immigration restriction policies, Clemens et al. (2017) and Lee et al. (2017) show that the exclusion of Mexican bracero workers in the 1960s and the repatriations of Mexicans in the 1930s had little effects on natives' wages and employment respectively.

I examine the causal impact of the decline in immigration due to the quotas on the Great Migration. Scholars have long argued the "immigrant-as-deterrent" hypothesis that the Great Migration was delayed because southern blacks faced intense competition with European immigrants in the northern labor markets (Thomas, 1972). Using the state-level and city-level panel data of the North between 1880 and 1950, Collins (1997) applies fixed effects model and finds empirical evidence that supports the theory. This study improves on Collins (1997) by identifying the causal effect with more advanced econometric methods and providing refined evidence on the selection of black migrants, i.e. who was more likely to migrate in response

[3]Another approach is to exploit exogenous immigrant inflows–refugees or repatriates–as natural experiments. Card (1990) studies the effect of Cuban refugees from the Mariel Boatlift on Miami's labor market. Other studies include Hunt (1992), Carrington and De Lima (1996), Angrist and Kugler (2003), Glitz (2012), Borjas and Doran (2015), and Foged and Peri (2016), etc. Borjas (2003) uses an alternative approach by defining labor markets in terms of skill cell. The results are not comparable to the wage effects identified using the geographic approach and there are disagreements upon the division of skill cells.

[4]Existing studies concerning the impact of the quota system include Greenwood and Ward (2015) on return migration and Massey (2016) on immigrants' selection. In a related work written concurrently with mine, Ager and Hansen (2017) find that the quota system pushed natives into low-wage occupations and caused the decline in population growth. My study focuses on manufacturing wages, a more direct measure of the labor market outcome than occupational scores that cannot capture the wage dynamics within occupations.

to the decline in immigration. In a broader sense, my finding adds to the literature on the impact of immigration on natives' internal migration, where existing studies have not reached consensus. Card (2001), Kritz and Gurak (2001), and Peri (2007) find no evidence of natives' out-migration in response to immigration. Borjas (2006) finds natives migrate out of areas immigrants migrate into.

I further gauge the effects of the immigration restriction on establishment size, capital and skill intensities, and labor productivity. If the immigration restriction reduces the unskilled labor supply and increases the price of unskilled labor, theoretically firms' skill intensity increases and the scale of production decreases, reducing demand for unskilled labor while having an ambiguous effect on the demand for skilled labor. The change in capital intensity and the demand for capital depends on whether capital complements unskilled labor or skilled labor more. The adjustments in production, especially the adjustment of capital, have important implications for the immigrant wage effect, yet relatively few studies empirically examine this issue.[5] Lewis (2011) finds that in the 1980s to the 90s more unskilled immigrants caused the US manufacturing plants to adopt less automated machinery.[6] Lafortune et al. (2015) present evidence of the substitution between capital and unskilled labor in manufacturing production in response to immigration shocks circa 1890. Lafortune et al. (2015) find that in the early 20th century the US agricultural production adjusted to immigration mainly by changing output mix and less by changing production methods. My study enriches the findings and adds to the literature from the historical perspective.

This paper is the first to examine the impact of the immigration restriction on technology adoption of electrification ongoing in this period. It provides empirical evidence for Acemoglu (2010)'s model that labor scarcity discourage technology innovation or adoption if technology is strongly labor complementary. Electrification features that manufacturers switched power sources from water wheels, water turbines, and steam engines to electricity. It prompted the reorganization of factories and the transition to new labor-intensive production methods (Devine, 1983; Schurr et al., 1990) and increased the use of unskilled labor in factory floor production

[5] See Lewis (2013) for a review of studies on the adjustments in production.

[6] Similarly, Hornbeck and Naidu (2014) show that the out-migration (albeit internal) of black laborers caused by the 1922 Mississippi flood led to more capital-intensive agricultural production.

(Gray, 2013). Viewing electrification as a technological transition that complemented unskilled labor, I empirically examine whether the immigration restriction stalled electrification.

The results show that the immigration restriction had a strongly positive impact on manufacturing wages: a 1-percentage-point decline in the foreign-born share in a county increased wages by 1.4%. The decline in the immigrant supply in a county also led to a significant inflow of native blacks: a 1-percentage-point decline in the foreign-born share corresponded to 0.5-percentage-point increase in the black share. Regarding manufacturing industrial production, I find that the immigration restriction slowed down the growth of the scale of production and impeded electrification in the manufacturing sector.[7] There is suggestive evidence that manufacturers increased capital intensity by investing in non-electrified machinery as a result of the labor shortage. Skill intensity and labor productivity increased as well in areas that experienced negative immigrant supply shocks.

2 Historical Background

2.1 Immigration Quota System in the 1920s

At the onset of the 20th century, the United States experienced a rising tide of new immigrants from Southern and Eastern Europe. Among the peak years, the annual immigration to the US exceeded 1 million and 70%- 80% of them came from Southern and Eastern Europe. The large inflows were temporarily disrupted by the outbreak of World War I but resumed quickly after the war (Figure 1).

In response to the huge inflows of new immigrants, anti-immigration sentiments developed rapidly in the US with assertion of the racial inferiority of new immigrants and their adverse impact on the country (Hourwich, 1969). In an address to the Congress of the US in 1903, President Theodore Roosevelt stated the principle of US immigration policy, which set the tone for the later immigration quota system: "We can not have too much immigration of the right kind, and we should have none at all of the wrong kind. The need is to devise some system by

[7] Symmetrically, Kim (2007) shows that the mass immigration between 1820-1920 contributed to the growth of factories in the US.

which undesirable immigrants shall be kept out entirely, while desirable immigrants are properly distributed throughout the country."[8] In 1907, the Dillingham Commission was convened to investigate the social and economic consequences of new immigrants from Southern and Eastern Europe. The Commission released a 42-volume *Reports of the Immigration Commission* in 1911 concluding that new immigrants were unable to assimilate and detrimental to the US and advocating legislation to restrict immigration using quotas and financial and literacy tests (Dillingham, 1911).

After the Literacy Act was vetoed twice in 1913 and 1915, Congress finally overturned President Wilson's second veto in 1917 and passed the Literacy Act that required adult immigrants to take a literacy test and excluded immigrants from the "Asiatic Barred Zone".[9] Although the Literacy Act did not explicitly select immigrants by ethnicity or origin except for Asians, the intention was to exclude immigrants mainly from Southern and Eastern Europe who were less literate due to the lack of mass schooling in their home countries (Easterlin, 1981).

The support for more restrictive immigration policies led to the passage of the Emergency Quota Act of 1921. The Emergency Quota Act set an annual limit to the number of immigrants admissible from each country in Europe, Africa, and Oceania to be "...3 per centum of the number of foreign-born persons of such nationality reside in the United States as determined by the United States Census of 1910" (United States. Department of Labor, 1922). Given that China and the countries in the "Asiatic Barred Zone" had already been excluded by the Chinese Exclusion Act of 1884 and the Literacy Act of 1917, the Emergency Quota Act assigned quotas to the rest of Asia based on the same criterion stated above, including Palestine, Syria, Cyprus, Hejaz, Iraq, Persia and Rhodes. Japan was excluded voluntarily under the Gentlemen's Agreement of 1907. The quota of a country, if unfilled, could neither be rolled over to the next year nor filled by immigrants from other quota countries. On the other hand, Canada, Mexico, and South American countries were exempt from the quotas. In the Emergency Quota Act of 1921, immigrants from countries subject to quotas could be admitted without charging to quotas after a full year of residence in countries exempt from quotas and this requirement for the length

[8] *Congress Record* 38:3 cited in *Legislative History of American Immigration Policy: 1798-1965* by Hutchinson (1981)

[9] It also required medical examinations and banned the entry of undesirable immigrants such as people who are mentally or physically defective, criminals, alcoholics, prostitutes, polygamists, anarchists and so on.

of residence was raised to 5 years in 1922. The quotas were effectively enforced right after the passage of the Emergency Quota Act. The total quotas assigned to Europe in 1921 were 357,803. The quotas of most European countries immediately became binding and the total inflow from Europe dropped by half in the first year of enforcement.[10] The maximum number of immigrants admissible each month was 20% of the total annual quota and the quotas of many countries were quickly exhausted in the first five months of the fiscal year.

The Emergency Quota Act of 1921 was to expire the next year and extended for two more years. The subsequent Immigration Act of 1924 made the quota system permanent and tightened the restriction by setting the quotas as 2% of the foreign-born population from each country in the 1890 Census of Population.[11] Due to the lower proportion (2% instead of 3%) and the choice of an earlier population base (the Census of 1890 instead of the Census of 1910), the quotas assigned to European countries in total were reduced to 164,667. The Emergency Quota Act of 1921 and the Immigration Act of 1924 together marked the establishment of the immigration quota system that had operated for more than 40 years until repealed by the the Immigration and Nationality Act of 1965. As shown in Figure 1, immigration from Europe to the US was greatly reduced under the quota system. The foreign-born population share in the US declined substantially from 13.2% in 1920 to 11.6% in 1930.

2.2 Discrimination against Southern and Eastern Europeans

The quotas were designed to be proportional to the foreign-born population base from the Censuses of Population and hence it imposed much stronger restrictions on new immigrants: Eastern and Southern Europeans constituted the majority of the immigrant inflows in the immediate pre-war period but they had not built up a significant population stock in the US yet when the quotas were imposed. By adopting the Census of 1890 as the population base, the Quota Act of 1924 further tightened the grip on the admission of Southern and Eastern European immigrants

[10] The total quotas during the FY 1921-1922 were actually not fully exhausted mainly due to a significant number of vacancies in the slots of Germany (28% filled, 19,053 used/68,059 total) and United Kingdom (55.2% filled, 42,670 used/77,342 total), who had both been given generous quotas beyond the levels of their pre-WWI inflows.

[11] Although less mentioned, the second provision of the Act states that effective from July 1, 1927, the quotas (2% of the foreign-born population base in the Census of 1890) will be replaced by a total annual quota of 150,000 in proportion to the inhabitants of the same national origin in the Census of 1920. In reality it was postponed and did not became effective until 1929.

since the majority of them arrived after 1890. Table A2 lists the quotas assigned to countries according to the Quota Act of 1921 and the Quota Act of 1924.

To demonstrate by how much the immigrant inflow from each country was constrained, Table A3 lists the ratios of the quotas to the average annual immigrant inflow between 1900 and 1914 for each European country under the simplified assumption that the immigrant inflow would have restored to its pre-WWI average level had there not been the quota system. The quotas assigned to Eastern and Southern European countries by the Emergency Quota Act of 1921 were between 15%-34% of their average pre-war annual inflows, except for the Russian Empire (76%) and Romania (159%). On the other hand, the quotas assigned to Western and Northern European countries were mostly above 70% of their pre-war annual inflows, except for Belgium (33%). The German Empire and Switzerland had quotas that even exceeded their pre-war annual inflows (236% and 110%). In the Quota Act of 1924, the quotas assigned to Eastern and Southern Europe further shrank to below 10% of their pre-war annual inflows. In the most extreme case, Greece was assigned an annual quota of 100 head counts in 1924 vis-a-vis a pre-war annual inflow of 8,507. The quotas assigned to Western and Northern Europe were reduced as well but by a much smaller magnitude and most quotas were above 30% of the pre-WWI annual inflows.

2.3 Regional Variation of Immigrant Supply Shocks

The quota system furnishes a unique chance to identify the causal effect of immigration on the outcomes of interest. Because of two features of US immigrants, it caused exogenous immigrant labor supply shocks that affected the US regions to various degrees.

First, immigrants from various sending countries show a great disparity in their locational preference of residence and in the level of concentration (Abramitzky and Boustan, 2017). Figures A1-A4 show the distributions of immigrants from European countries in the US counties in 1900 as heat maps where the darker color represents a higher proportion of immigrants living in this county in 1900. Table A4 shows the top 3 states and counties preferred by immigrants from each country in terms of residence in 1900, i.e. the 3 states and counties with the highest immigrant shares of all immigrants in the US from the same country. For instance, column 1

row 1 indicates that 22.8% of all Austrian-Hungarians in the US lived in the state of New York in 1900. Eastern European immigrants, especially Turkish and Romanians, were concentrated in the northeast industrialized area in 1900 and a considerable share of Austrian-Hungarians, Polish, and Russians lived in the Midwest. Southern Europeans preferred to living in the Northeast and the West. On the other hand, Western and Northern European immigrants had quite distinctive distributions across the US compared to Southern and Eastern European immigrants. Western European immigrants in general were scattered in the Northeast, the Midwest, and the West. There was a large proportion of Scandinavians concentrating in the very north such as Minnesota and Wisconsin.

Second, studies show that US immigrants tend to settle where earlier immigrants of the same origin are living (Bartel, 1989; Dunlevy and Gemery, 1977; Gallaway et al., 1974, Lafortune and Tessada, 2010). The explanations of the strong tendency of newcomers to settle in ethnic enclaves include family reunion, ethnic good provision, and social networks that reduce the job search cost.

Given these two features, regions that had received more immigrants from Southern and Eastern European countries experienced a greater reduction in the immigrant inflows and regions that had received more immigrants from Western and Northern European countries experienced a smaller reduction in the immigrant inflows. I exploit this variation and quantify each region's immigrant labor supply shock as the instrument for the change in the region's foreign-born share between 1920 and 1930.

2.4 The Great Black Migration

The decade 1920-1930 also saw the continuation of the Great Migration that originated at the beginning of the 1910s, with millions of African Americans leaving their hometown in the South (Wilkerson, 2011; Boustan, 2016). Figures 2a and 2b show the change in the black labor force share at the state level and at the county level between 1920 and 1930. The South as a whole experienced a significant decline in the black population while non-southern states saw the black population grow substantially. The county-level heat map reveals that there was also substantial migration of the black population within the southern states, typically from rural to

urban counties.

The timing of the Great Migration is somewhat puzzling that attracted scholars' interest to study its causes for decades: given the substantial income gap between the South and the North, African Americans did not initiate the mass migration until 50 years after the emancipation. On the other hand, the Great Migration took place at the downturn of immigration to the US due to the interruption of the World War I and the subsequent immigration restriction. This led to the speculation that southern blacks were discouraged by the competition for job opportunities with European immigrants and they migrated only when the international migration withered, as Brinley Thomas states "the Negroes found that their only chance of making any headway was at times when the immigration tide was going out" (Thomas, 1972). Collins (1997) shows empirical findings that support the theory. In the second section of the empirical analysis, I revisit this hypothesis and quantitatively examine the causal relationship of the immigrant restriction on the Great Migration.

3 Data

The data used in this study are compiled from several sources. The lack of individual wage data with national coverage in this period poses a challenge. I use the county-level tabulations of the 1919 and 1929 Censuses of Manufactures already digitized by Haines (2010) that record the total wage bill paid to wage workers and the average number of wage workers employed in the manufacturing sector in the census year. However, the limitation of the wage data is that I cannot distinguish between immigrants' and natives' wages. As a result, the estimated wage effect may be influenced by the composition effect that I discuss later in greater detail. I adjust county boundaries for consistency from 1900 to 1930.[12] and drop counties with missing values of manufacturing wages in either 1919 or 1929.

I also digitize the industry-by-state-level tabulations of the 1919 and 1929 Censuses of Manufactures that report the total wage bill of wage workers, the total salary bill of salaried workers,

[12]The adjustments of county boundaries are based on the Atlas of Historical County Boundaries Project by Newberry Library (http://www.randymajors.com/p/maps.html) If a county is created from a segment of another county, I merge both counties and aggregate the statistics. If a county is created from several segments of more than one county, I merge all counties involved and aggregate the statistics.

and more variables about manufacturing industrial production than county-level tabulations. I compile statistics on the total number of establishments, the total wage bill, the total salary bill, the number of wage workers, the number of salaried workers, the total horsepower, the electric horsepower, and the total value added of products in each 4-digit and 2-digit industry by each state.[13] I use horsepower as the proxy for capital because the 1929 Census of Manufactures stopped reporting capital. Horsepower is considered to be a reasonable measure of capital given that the correlation of capital and horsepower in the 1919 Census of Manufactures is above 0.9.

The average manufacturing wage is calculated as the total wage bill paid to wage workers divided by the average number of wage workers employed in this year. The average manufacturing salary is calculated as the total salary bill paid to salaried workers divided by the average number of salaried officers and staff employed in this year. Wages and salaries in 1930 are deflated to the price level in 1920 using the national CPI index. Regarding indicators of manufacturing industrial production, establishment size in terms of labor and capital is measured as wage workers per establishment and horsepower per establishment respectively; skill intensity is measured as salaried worker to wage worker ratio; labor productivity is measured as horsepower per wage worker; electrification ratio is measured as electric horsepower to total horsepower ratio. The industrial composition of the manufacturing sector is measured as the employment shares of all 16 2-digit manufacturing industries.

To obtain regional demographic and sectoral characteristics at both the county level and the state level, I use full-count samples of 1920 and 1930 Censuses of Population from the Integrated Public Use Microdata Series (IPUMS) (Ruggles et al., 2016).[14] I keep individuals aged between 16-65 in the labor force and aggregate them to the county level and the state level to calculate the foreign-born labor force share, the black labor force share, the female labor force share, the age composition (the labor force shares of age groups 16-24; 25-34; 35-44; 45-54; 55-65), the urban labor force share, and the agriculture and manufacturing labor force shares in each county and in each state. The county-level data aggregated from the Censuses of Population are matched with the county-level manufacturing data and the state-level aggregate

[13]The two-industry classification is merged and harmonized from the 1919 and 1929 four-digit industry classifications. Check the data appendix for description.

[14]Using the full-count sample avoids the classical sampling error so the analysis suffers no attenuation bias that may occur when the sample size in each cell is not large enough (Aydemir and Borjas, 2011).

population data are matched with the industry-by-state-level manufacturing data. Table A1 lists all the sources and availability of statistics and the construction of the variables.

To construct the instrumental variable, I collect the annual immigrant inflows and quotas by country from the *Annual Reports of Commissioner-General of Immigration to the Secretary of Labor* of various years (1892-1929) and *International Migrations: Volume I Statistics* by Ferenczi and Willcox (1929). Post-WWI Europe witnessed the collapse of empires and the rise of nation states, so I merge post-war countries that used to be the same country to obtain a consistent account of immigration statistics over time. The countries comprise Austria-Hungary (Austro-Hungarian Empire), Belgium, Denmark, France, Germany (German Empire), Great Britain, Greece, Ireland, Italy, Norway, Poland, Romania, Portugal, Russia (Russian Empire), Switzerland, Sweden, Spain, and Turkey (Ottoman Empire).[15]

[Table 1 Here]

The summary statistics are presented in Table 1. The sample includes 2330 counties of 48 states (excluding Hawaii and Alaska) and District of Columbia. The sample of the South includes 992 counties of 14 southern states.[16] The sample of the North includes 1338 counties of all 34 non-southern states and District of Columbia.[17] Between 1920 and 1930 the real manufacturing wage grew substantially by 18.1% in the North but stagnated in the South. The real manufacturing salary increased significantly both in the North and in the South (by 35.0% and 24.7%). Due to the immigration restriction, the national foreign-born labor force share fell from 19.8% to 16.8%. As a result of the Great Migration, the black labor force share increased in the North from 3.4% to 4.2% and decreased in the South from 32.8% to 30.1%. In the manufacturing sector, establishment size (wage earners per establishment and horsepower per establishment), capital intensity (horsepower per wage worker), labor productivity (value added

[15] See details in the data appendix.

[16] The South includes 6 states in South Atlantic region (Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia) and 8 states in the South Central region (Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee, Texas). Delaware, D.C., and Maryland in the South Atlantic region are not considered part of the southern economy in the history.

[17] For convenience, I use "North" to refer to all non-southern states that strictly also include Western and Mountain states.

per wage worker), and electrification (electric to total horsepower ratio) grew significantly both in the South and in the North. Regarding manufacturing industrial composition, the South was dominated by relatively low-value-added and low-skilled industries (e.g. textile and forest products) and the North had a larger share of high-value-added and capital-intensive industries such as machinery, iron and steel products.

4 Empirical Framework

4.1 County-Level Regression Specification

Consider a first-difference regression of 1920 and 1930 cross sections to estimate the effect of immigrants on wages exploiting the county-level variation of immigration penetration:

$$\Delta Y_i = \alpha \Delta \frac{IM_i}{LF_i} + \Delta X_i \beta_1 + \beta_2 S_i + c + \omega_i \tag{1}$$

Y_i in the first section of the analysis is simply $ln(w)_i$, the natural log of the average manufacturing wage in county i. In the section section when examining the effect of immigrants on the Great Migration, Y_i is the black labor force share in county i, $\frac{Black_i}{LF_i}$. To study the effect on the South-to-North black migrants exclusively, Y_i is the labor force share of the blacks born in the South to identify, as best I can, the blacks who previously lived in the South. To further examine the selection of black migrants, Y_i includes the labor force shares of illiterate and literate blacks; skilled and unskilled blacks; male and female blacks; all, literate, and unskilled black birth cohorts of five-year-intervals between 1865 and 1904, and the labor force shares of these subgroups of the blacks born in the South.[18] In the third section, Y_i is a set of indicators of manufacturing industrial production including wage workers per establishment, horsepower per establishment, horsepower per wage worker, and value added per wage worker in county i.

$\frac{IM_i}{LF_i}$ is the foreign-born labor force share in county i that measures the level of immigration penetration. X_i is a set of characteristics of county i that includes the female labor force share, labor force shares of all age groups, and the urban labor force share to account for the com-

[18]The birth cohorts of five-year-intervals are eight birth cohorts who were born between 1865-1869/1870-1874/1875-1879/1880-1884/1885-1889/1890-1894/1895-1899/1900-1904.

position effect of the gender, age, and sectoral structures of the labor force. S_i is the dummy for county i being part of the South. The postbellum South and the North were still relatively segmented in this period (Rosenbloom, 1996). The South lagged behind the North with lower wages and attracted fewer immigrants (Wright, 1987). Not taking into account this North/South difference may lead to biased estimates. c is the constant term and ω_i is the idiosyncratic error term. The standard error is clustered at the state level. The regression is weighted by the county's total labor force size to account for the different sizes of counties.[19]

Although the first-difference estimation differences out the time-invariant component in the error term correlated with the immigrant share, the estimate of α is biased if the immigrant share is correlated with the region-specific time-variant unobservables, e.g. a booming labor market with increasing wages and job opportunities.

To address the endogeneity problem, I use the immigration policy shock as the instrumental variable for the change in the foreign-born share. In the first-stage regression, the change in the foreign-born share in county i is regressed on the instrumental variable–excluded immigrants divided by the labor force in county i in 1920 ($\frac{EI_i}{LF_{i1920}}$)–and the second-stage full covariates as follows:

$$\Delta\frac{IM_i}{LF_i} = \gamma\frac{EI_i}{LF_{i1920}} + \Delta X_i\lambda_1 + \lambda_2 S_i + c + \varepsilon_i \tag{2}$$

As Clemens and Hunt (2017) point out, the common use of ratios with a shared denominator as both dependent variable and explanatory variable in the immigration literature may cause a spurious correlation in the first stage and overstate the power of the instrumental variable.[20] As a remedy, I control for the reciprocal of the denominator $\frac{1}{LF_{i1920}}$ in the first stage (which automatically enters the second stage) as Kronmal (1993) suggests.

[19]For the first-difference regressions, the weight is $1/(1/LF_{i,1920}+1/LF_{i,1930})$. For 1920 and 1930 cross section regressions, the weight is the county's labor force size in the corresponding year, $LF_{i,1920}$ and $LF_{i,1930}$.

[20]Strictly speaking, in equation (2) the dependent variable and the instrument do not share the exact same denominator but the correlation between the two denominators ($LF_{i1920} \times LF_{i1930}$ and LF_{i1920}) is 0.88.

4.2 Projection of Excluded Immigrants

To estimate the number of immigrants excluded from each US region by the immigration quotas, I first project the "no-quota" counterfactual immigrant inflow from each sending country, assuming no immigration quotas had been imposed. The theory to support the projection of the immigrant inflows is the "emigration life cycle" theory (Hatton and Williamson, 1998).[21] It states that a country's emigration experience typically follows a bell-shaped pattern: the emigration increases first (often sharply) and declines as the industrialization progresses. This life cycle pattern of emigration experience is first observed among Swedish emigrants (Akerman, 1976) and later generally applies to most European countries in the Age of Mass Migration (Massey, 1988; Hatton and Williamson, 1998). Since Eastern and Southern European countries industrialized later than Western Europe and Scandinavia, their emigration also reached the peak later. The quota system was established at the downswing segment of the emigration cycles of "old" immigrants from Western and Northern Europe and the upswing or the peak segment of those of "new" immigrants from Eastern and Southern Europe (see Figure 3).

In the literature the general approach to estimate the emigration life cycle is by considering a country's total emigration as a non-linear (usually quadratic) function of time (Hatton and Williamson, 1998). However, the limited availability and lack of consistent accounts of population and emigration statistics–especially in Eastern Europe–prohibit me from following this conventional approach. Considering that the US was the predominant destination of European emigrants, the sending country's total emigration and its emigration to the US were highly synchronized so it is reasonable to presume a country's emigration to the US showed the similar life cycle. Therefore, I consider the immigration from each sending country as a function of the time $I(t)$ and use fractional polynomial curve-fitting to simulate the complete life cycle curve. The fractional polynomial method searches through a given set of powers for the best-fitting model based on Akaike Information Criterion (Royston and Altman, 1994). It includes the standard quadratic and cubic curve-fitting as a subset and is more flexible in estimating the

[21] It is first formally hypothesized by Zelinsky (1971) and has been given several different names, including "mobility transition" (Zelinsky, 1971), "migration curve" (Akerman, 1976), "migration transition" (Gould, 1979), and "emigration life cycle" (Hatton and Williamson, 1998). I choose "emigration life cycle" because it fits most into the context of the study.

emigration life cycle curve at its different stages.

Ideally the emigration life cycle curve can be estimated using the annual inflow by source country in the pre-quota (pre-1921) period to project the "no-quota" counterfactual in the post-quota (post-1921) period. However, I have to discard the immigrant inflow during the World War I and post-war years before the quota system (1915-1920) because the World War I threw the transatlantic shipping business into disarray and disrupted the immigration to the US. Incorporating the abnormally low immigrant inflows in these years into estimation will likely distort the contour of the emigration life cycle curve. The immigrant inflow in 1921–the year right before the quotas were enforced–appears to have recovered to a normal level. Considering that the immigrant inflow in 1921 can be indicative of the "natural" post-WWI immigration level without the quotas, I include in estimation the immigrant inflow in 1921 as an "anchor" for the natural level of post-war immigrant inflows.[22] For each country, I estimate the best-fitting fractional polynomial curve I_{st} from country s in year t, using immigrant inflows from 1879 to 1914 and in 1921. Then I use the model to project the counterfactual inflows $\hat{I}_{st}$ from 1922 to 1929.

The fitted curves of the immigrant inflows from all European countries between 1880 and 1930 are plotted in Figures 4 and 5 as dash-dotted line, together with the actual inflows (thin solid line) and the annual quotas (thick solid line). Among Eastern and Southern European countries, Austria-Hungary, Poland, Russia, Italy, and Greece show a stylized pattern of the emigration life cycle. In the cases of Romania, Turkey, Portugal, and Spain, pre-war immigrant inflows are insufficient to project a complete life cycle and the projected curves show monotonic upward trends. Though this can potentially lead to unrealistic projected values, a cross-country comparison of emigration rates (emigrants per 1000 population) indicates that even the highest projected immigration inflows from these countries are still within the reasonable range and below the peak value of the immigrants inflows from countries that have experienced the whole life cycle.[23] The emigration from most Western and Northern European countries had passed the peak in the late 19th century so the fitted curves are either stationary or showing slightly

[22] In the robustness check, I exclude the immigrant inflow in 1921 to project the curve and the regression results are not sensitive to the exclusion of the immigrant inflow in 1921.

[23] The highest emigration rate based on my projection is around 6 and the highest rates of Ireland and Sweden are above 10.

upward or downward trends.

The juxtaposition of the projected inflows and the annual quotas indicates that in general immigrants from Eastern and Southern European countries experienced greater constraints imposed by the quotas and a large number of immigrants from these countries were "excluded" as their projected inflows far exceeded the quotas. On the other hand, the constraints imposed on immigrants from Western and Northern European countries were much weaker. The total number of excluded immigrants, EI_s, from source country s in this decade is calculated as the sum of the counterfactual inflows $\hat{I}_{st}$ minus the quotas Q_{st} during 1922-1929, where the counterfactual inflow is lower than the quota I set the number of excluded immigrants as zero assuming no gain of immigrants because of the quotas:

$$EI_s = \sum_{t=1922}^{1929} max\left(\hat{I}_{st} - Q_{st}, 0\right) \tag{3}$$

Next I allocate the excluded immigrants to each US region (county or state) based on the historical geographical distribution of immigrants from each source country in the 1900 US Census of Population. Specifically, suppose IM_{si1900} is the number of immigrants from source country s who live in the US region i (county and state) in 1900, then the immigrant share in the US region i from country s of the total immigrants from the same country s (denoted as P_{si}) is calculated as:

$$P_{si} = \frac{IM_{si1900}}{\sum_{i \in I} IM_{si1900}} \tag{4}$$

With the distribution $S \times I$ matrix of immigrants from all countries S, the excluded immigrants from each source country s assigned to each US region i (denoted as EI_i) are calculated as follows:

$$\begin{bmatrix} \Delta I_1 & \Delta I_2 & \dots & \Delta I_{S-1} & \Delta I_S \end{bmatrix} \begin{bmatrix} P_{11} & \cdots & P_{1I} \\ \vdots & \ddots & \vdots \\ P_{S1} & \cdots & P_{SI} \end{bmatrix} = \begin{bmatrix} EI_1 & EI_2 & \dots & EI_{I-1} & EI_I \end{bmatrix} \tag{5}$$

$$where \quad EI_i \equiv \sum_{s \in S} P_{si} \times \Delta I_s \tag{6}$$

Normalized by region i's total labor force in 1920, LF_{s1920}, the regional immigration policy shock is calculated as $\frac{EI_s}{LF_{s1920}}$. It is used in the first-stage regression as the instrumental variable for the actual change in the foreign-born share between 1920 and 1930. The "excluded immigrants" instrument at the state level and the county level is shown in Figures 6a and 6c as heat maps and the change in the foreign-born share between 1920 and 1930 is shown in Figures 6b and 6d. The maps indicate that the number of excluded immigrants (normalized) and the decline in the immigrant share show similar geographic distributions. The majority of the South was minimally affected because of its small historical stock of European immigrants. In Figure 7, I plot all counties in the 2-dimensional graph with the "excluded immigrants" instrument on the y-axis and the change in the foreign-born share between 1920 and 1930 on the x-axis. The size of the circle represents the county's labor force size in 1920. The fitted line in Figure 7 reveals a negative correlation, consistent with the intuition that the foreign-born share was more likely to decline in a county if the county had more immigrants "excluded" by the quotas.

4.3 Industry-by-State-Level Regression Specification

I supplement the analysis with the industry-by-state-level regressions because the industry-by-state-level manufacturing data have more variables than the county-level manufacturing data. The first-difference regression specification is as follows:

$$\Delta Y_{ij} = \alpha \Delta \frac{IM_i}{LF_i} + \Delta X_i \beta_1 + \beta_2 S_i + \eta_j D_j + c + \varepsilon_{ij} \tag{7}$$

Each observation is an industry j in state i. In the first section of the analysis, Y_{ij} is the natural log of average wage and average salary in industry j in state i. When examining the effects on industrial production, Y_{ij} includes wage workers per establishment, horsepower per establishment, horsepower per wage worker, value added per wage worker, salaried worker to wage worker ratio, electric horsepower per wage worker, and electric horsepower to total horsepower ratio in industry j in state i.

On the right hand side, $\frac{IM_i}{LF_i}$ is the foreign-born labor force share in state i and it is instrumented by the "excluded immigrant" instrument constructed at the state level in the first stage regression.[24] X_i is a set of characteristics of state i that includes the female labor force share, the age composition, and the urban labor force share. D_j is the dummy for industry j to capture the industry-specific trend. ε_{ij} is the error term. The standard error is two-way clustered at both the state level and the industry level. The regression is weighted by the employment size of the industry in the state.

5 Empirical Results

5.1 The Impact on Manufacturing Wages

5.1.1 County-Level Analysis

Table 2 shows the estimates from the first-difference wage regressions at the county level. The WLS estimates are presented in columns 1-4 and the 2SLS estimates in columns 5-8. Column 1 shows the WLS estimates from regressions including the foreign-born share as the only explanatory variable. Column 2 adds the female labor force share, the urban labor force share, and the age composition. Column 3 adds the dummy for the South. Column 4 further controls for the manufacturing industrial composition, i.e. the employment shares of all 2-digit manufacturing industries. Columns 5-8 show the 2SLS estimates from the regressions that follow the specifications in columns 1-4 in the exact same order. The lower panel show the first-stage estimates and F-statistics of the 2SLS regressions.

[Table 2 Here]

In Table 2 column 1, the WLS estimate of the coefficient on the foreign-born share is -0.409 and statistically insignificant when the foreign-born share is included as the only explanatory

[24] It is worth noting that workers may endogenously choose industries, which my instrument is unable to address. Nonetheless, this specification mainly exploits the variation of the immigrant share at the state level, therefore the endogenous sorting at the industry level is less of an issue here as long as each state is considered as an integrated labor market.

variable.[25] The coefficient in column 2 becomes -0.757 and statistically significant at the 10% level after controlling for the region's labor force characteristics. However, the effect largely disappears (-0.163 and -0.125) after controlling for the South dummy in columns 3-4. The negative and statistically significant coefficients (-0.182 and -0.167) on the South dummy in columns 3-4 imply that the North as a whole had wage growth significantly higher than the South in this decade.

In columns 5-8, the first-stage F-statistics are reasonably large and the negative coefficients on the instrument (all statistically significant at 1% level) are consistent with the negative correlation observed in Figure 7. In the second stage, the estimates of the coefficients on the foreign-born share show a strongly negative effect of immigrants on manufacturing wages, indicating a substantial upward bias in the first-difference WLS estimates. In column 5, the coefficient is -3.141 without adding other covariates. After controlling for the female labor force share, the age composition, and the urban labor force share, the coefficient shrinks to -2.333 in column 6. In column 7, the coefficient decreases to -1.720 when the South dummy is controlled for in the regression. Adding the manufacturing industrial composition, column 8 shows that the shift of the industrial composition has a non-negligible effect on the regional wage level due to the inter-industry wage differentials, reducing the effect to -1.441.[26] The interpretation of the coefficient on the foreign-born share in column 8 is that a 1-percentage-point decline in the foreign-born labor force share increased the average manufacturing wage by 1.44% at the county level.

The wage effect in this study is considerably strong, compared to the weak wage effects found in the literature on the modern US. Translated into the comparable term to the meta-analysis in the National Academies Report (Blau and Mackie, 2016, pp.183, Table 5-2), the wage effect at the county level in column 8 is about -1.2.[27] Most results in the table are from

[25] Compared to the positive coefficients in the cross-sectional WLS estimates presented in the Online Appendix, the results show that first-difference estimation eliminates a substantial part of the upward bias from the time-invariant component in the error term that is correlated with the foreign-born share.

[26] On the other hand, it is arguable that the shift of industrial composition could be affected by the immigrant supply as the Heckscher-Ohlin model indicates that a multi-sector economy could shift the composition of sectors of different factor intensities to absorb the change in relative supplies of factors and keep the relative prices constant within the "cone of diversification".

[27] The table shows the wage elasticity in each previous study: how much the % change in wage is when the immigrant inflow increases the labor supply by 1%.

nil to -0.6 and three studies (Altonji and Card, 1991; Borjas, 2017; Llull, 2015) find strongly negative effects between -1.4 to -1.7. Regarding historical studies, the evidence leans towards large wage effects, including Goldin (1994) (-1.2 to -3.0) and Hatton and Williamson (1995) (-1.0 to -1.3).

5.1.2 Industry-by-State-Level Analysis

Table 3 presents the results of the industry-by-state level regressions. Panel A and Panel B show the results of the regressions using the changes in the natural log of wages and salaries as the dependent variables respectively. In columns 1-3 the sample is 2-digit manufacturing industries in all states and D.C. and in columns 4-6 the sample is 4-digit manufacturing industries in all states and D.C.

[Table 3 Here]

In Panel A, the results show a strongly negative effect of immigrants on wages as identified in the county-level wage regressions. The effect at the 4-digit-industry-by-state-level (-1.511) in column 3 is similar to the county-level result (-1.441) and the effect at the 2-digit-industry-by-state-level is more negative (-3.269) in column 6. Panel B shows that immigrants also have a strongly negative effect on salaries (-3.413 in col. 3 and -2.365 in col. 6).

The effect of the immigration restriction on salaries (skilled wages) was likely to be indirect since the immigrants excluded by the quotas were largely unskilled and closer substitutes to unskilled natives. The potential channel is via the adjustments in production: for instance, the higher input of capital in response to the unskilled immigrant supply shock, combined with the capital-skill complementarity arising in the late 19th century (Lafortune et al., 2015), pushed up the demand for skilled labor and increased salaries. I examine the effects of immigrants on the adjustments in production directly in the later section.

Because I cannot distinguish between natives' and immigrants' wages, the effect of immigrants on wages may be exaggerated by the composition effect: when the immigrant share increases, the average wage may fall at least in part because immigrants have lower average

wages than natives. Hence the estimates in the study should be considered the upper bound of the true wage effect. The Dillingham report indicates that immigrants on average earned 25% less than natives. Using this figure, I can calculate that average wage would have fallen by 0.26%–only a small fraction of the estimated effect–due to the composition effect if the immigrant share increased by 1%. The Local Average Treatment Effect of the instrument (Imbens and Angrist, 1994) implies that the estimated wage effect applies to where the immigrant supply declined mainly due to the exclusion of Southern and Eastern Europeans who had a greater wage disadvantage than an average immigrant, thus the composition effect could have been larger. Even so, the negative wage effect remains strong.

5.2 The Impact on the Great Migration

5.2.1 County-Level Analysis

Table 4 shows the estimates of the effect of immigrants on the Great Migration. The WLS results are presented in columns 1-3. Column 1 only controls for the South dummy. Column 2 adds the foreign-born share and column 3 controls for the full covariates. The 2SLS results are presented in columns 4-7. Columns 4 controls for the foreign-born share, the South dummy, and 1/labor force in the 1920. Column 5 controls for the full covariates. In columns 6-7, I split the sample into the North and the South to examine if there is a difference in the responsiveness to immigrants between the inter-regional (South-to-North) migrants and the intra-regional (within-South) migrants. The dependent variable in Panel A is the change in the labor force share of all blacks and the dependent variable in Panel B is the change in the labor force share of the blacks born in the South between 1920 and 1930.

In particular, I control for the existing black migrant stock in 1920 in the full regression specification in columns 5 and 6 to account for the "chain migration" effect due to the growing migrant network (Carrington et al., 1996). The black migrant stock in a county is measured as the county's labor force share of the blacks born in the South in the 1920 Census. In the South sample, I do not control for the black migrant stock (in column 5 the value is zero for all

southern counties).[28]

[Table 4 Here]

In Panel A column 1 the coefficient on the South dummy is a statistically significant -0.029, indicating a net flow of the black population from the South to the North. The WLS estimates of the coefficient on the foreign-born share is -0.122 in column 2 and -0.155 in column 3 when controlling for the full covariates. Note that in column 3 the coefficient on the black migrant stock is 0.150 and statistically significant, implying that a larger migrant stock in the northern region would attract more subsequent migrants. In column 4, when the foreign-born share is instrumented the coefficient becomes -0.539, although statistically insignificant. The coefficient on the South dummy is reduced to -0.012 and becomes statistically insignificant. It implies that a large fraction of the South-to-North migratory flow could be attributed to the causal effect of the decline in the immigrant supply on migration. With the full covariates included in the regression, the coefficient on the foreign-born share in column 5 is -0.499 and statistically significant at 5% level. The coefficient on the South dummy is -0.013 and the coefficient on the black migrant stock is 0.171, positive and statistically significant. The 2SLS estimates show that the WLS estimates are biased upward because both immigrants and black migrants were likely to settle in areas with booming labor markets. In the split-sample analysis, the coefficient on the foreign-born share is -0.373 in the North sample (col. 6) and -0.435 in the South sample (col. 7). In column 6, the statistically significant coefficient of 0.159 on the black migrant stock implies a positive effect of existing migrant stock on the subsequent inflow of the black population.

Panel B presents the effect of immigrants on the migration of the blacks born in the South only. The results show a consistent pattern as in Panel A. In column 5, the coefficient on the foreign-born share in the full specification is -0.309 (compared to -0.499 in Panel A). It means that 1-percentage-point decline in the foreign-born share of a county led to a 0.309-

[28] In an alternative specification, I measure the black migrant stock in the South as the share of black population born in other southern states but the coefficient on the black migrant stock is negative and statistically significant, which is against the theory. It implies that either the chain migration effect does not exist or it is harder to estimate within the South given the limitation of the data to identify one's previous location of residence.

percentage-point increase the labor force share of the blacks born in the South and a 0.499-percentage-point increase the labor force share of all blacks. In addition, the coefficient on the foreign-born share in the South (-0.342) in column 7 is more negative than in the North (-0.183) in column 6, although the difference is not statistically significant. Possible explanations are that the southern black workers were more aware of the labor market condition of areas in closer proximity to them or they were well-informed but deterred by distance (Collins and Wanamaker, 2015).

5.2.2 The Selection of Black Migrants

I then examine the selection of black migrants, i.e. the characteristics of the black migrants who responded to the lessened competition with immigrants in the labor market.[29] I estimate the coefficient on the foreign-born share using the change in the labor force share of various black subgroups as the dependent variable in the 2SLS regressions. The regression specification is the same as in Table 4 column 5. Figures 8a presents the point estimates as well as the 95% and 90% confidence intervals of the coefficients on the foreign-born share using the all black share, literate and illiterate black shares, skilled and unskilled black shares, male and female black shares as the dependent variables. Figure 8b presents the estimates from the regressions using the corresponding shares of the blacks born in the South as the dependent variables. Figure 8a shows that literate blacks were significantly more likely to migrate and to have unskilled occupations.[30] Black women were more likely–although not significantly–to migrate than black men in response to the decline in the immigrant supply. Figure 8b shows a same pattern when focusing on the selection of the blacks who were born in the South.

I further explore the heterogeneous effects of immigrants on different birth cohorts within each group (all blacks; southern blacks; literate blacks; literate southern blacks; unskilled blacks; unskilled southern blacks). In Figure 9, I plot the point estimates and confidence intervals of the coefficients using the change in the labor force share of different black birth cohorts of each group as the dependent variable from the 2SLS regressions. Figure 9 indicates that

[29]Regarding the selection of migrants during the first wave of the Great Migration in general, Collins and Wanamaker (2014) study a linked census sample from 1910 to 1930 and find weak evidence of positive selection.

[30]However it does not imply the migrants possessed low skill *ex ante*. Black migrants might be forced to take unskilled jobs after migration since they experienced substantial discrimination in the North.

younger birth cohorts (born between 1890-1894; 1895-1899; 1900-1904) were more likely to migrate and the conclusion is consistent across various subgroups.

To sum up, black migrants responded to the decline in the immigrant supply caused by the quota system and this causal relationship explains a substantial fraction of the total migration. The black migrants were more positively selected in terms of literacy and they were likely to end up with unskilled jobs. The sex ratio of the migrants was relatively balanced and younger cohorts of the blacks moved more.

5.3 The Impact on Industrial Production

In this section, I study how the immigration restriction affected various aspects of manufacturing industrial production and discuss the influence on industrial development. Despite the internal migration of native labor, marginal adjustments can take place on the production side in response to the immigrant shock as well (Lewis, 2013). I examine the effects of the immigration restriction on the scale of production, capital and skill intensities, labor productivity, and technology adoption of electrification.

5.3.1 County-Level Analysis

Table 5 presents the WLS and 2SLS results of the regressions at the county level. Columns 1-2 show the WLS estimates from the regressions with and without the full covariates. Columns 3-7 show the 2SLS estimates from the regressions. In column 3, I control for the foreign-born share and 1/labor force in 1920 in the regression. I further control for the female share, the urban share, and the age composition in columns 4 and 6. The labor force shares of manufacturing industries are included in the regressions in columns 5 and 7. I present the 2SLS results both without the South dummy (cols. 4-5) and with the South dummy (cols. 6-7).[31]

[Table 5 Here]

[31] In the case of industrial production, it is less clear if there is a gap between North and South after controlling for the industrial composition so I present both results with or without the South dummy.

Concerning the effects on establishment size, the WLS estimates of the coefficient on the foreign-born share in column 2 are 2.010 in Panel A and 0.774 in Panel B using the change in wage workers per establishment and horsepower per establishment as the dependent variables respectively. When the foreign-born share is instrumented, the 2SLS estimates show significantly stronger effects on both wage workers per establishment and horsepower per establishment than the WLS estimates: after controlling for the full covariates, a 1-percentage-point decline in the foreign-born share decreased wage workers per establishment by 6.45% and 7.86% and decreased horsepower per establishment by 5.06% and 7.10%, without and with the South dummy (cols. 5 and 7) respectively.

When turning to the effects on capital intensity and labor productivity in Panel C and Panel D, the decline in the immigrant labor supply increased horsepower per wage worker and valued added per worker. The 2SLS estimates show that a 1-percentage-point decline in the foreign-born share increased the horsepower per wage worker by 1.39% and increased the value added per wage worker by 2.00% (col. 5). The results suggest that the decline in the immigrant supply prompted the adjustment of capital and increased unskilled workers' productivity (Jerome, 1934), which may have amplified the wage effect of immigrants. The evidence is contingent to the inclusion of the South dummy and the effects become smaller (0.76% and 0.53% respectively) and statistically insignificant in column 7 when the South dummy is included.

5.3.2 Industry-by-State-Level Analysis

Table 6 presents the 2SLS estimates from the industry-by-state-level regressions on industrial production. In addition to the outcomes in the county-level regressions, I examine immigrants' effects on electrification (electric horsepower per wage worker and electric horsepower to total horsepower ratio) and skill intensity (salaried worker to wage worker ratio). In Panel A the sample is all 2-digit industries in all states and D.C. and in Panel B the sample is all 4-digit industries in all states and D.C.

[Table 6 Here]

The effects on establishment size (wage workers per establishment and horsepower per establishment), capital intensity (horsepower per wage worker), and labor productivity (value added per wage worker) are consistent with the county-level regressions, except that the effects are stronger at the industry-by-state level (cols. 1-4).

Regarding electrification, column 5 shows that the negative immigrant supply shock did not stimulate the adoption of electrified machinery. On the contrary, the positive coefficients in column 5 (4.694, statistically insignificant in Panel A and 13.055, statistically significant at 5% level in Panel B) indicate that manufacturers in fact reduced the investment in electrified machinery per unskilled worker facing the immigrant labor shortage. This suggests that the increase in horsepower per wage worker (col. 3) was contributed by the increase in the adoption of non-electrified machinery, i.e. machinery powered by water wheels, water turbines, and steam engines instead of electricity. Column 6 shows that the electric horsepower to total horsepower ratio declined significantly when the immigrant supply decreased, meaning that the immigration restriction slowed down the electrification process. A 1-percentage-point decline in the foreign-born share decreased the electric horsepower to total horsepower ratio by 2.99-percentage-point (Panel A) or 2.05-percentage-point (Panel B). Column 7 shows that salaried worker to wage worker ratio increased in response to the decline in the immigrant supply.

The results in Tables 5 and 6 indicate that the immigration restriction curtailed the growth of the scale of production due to the decrease in the labor supply and the rising labor cost. Evidence also suggests that manufacturers shifted towards more capital-intensive production methods in response to the negative immigrant supply shock by investing more in non-electrified machinery, which increased the productivity of unskilled labor. On the other hand, the stagnation of electrification caused by the immigration restriction implies that this technological transition to electrified production might require the abundant supply of unskilled workers (Gray, 2013).

6 Robustness Checks

6.1 Sensitivity to Projection

One concern of the instrumental variable is whether the results are peculiar to the method I choose to project the immigrant inflows and the corresponding estimates of excluded immigrants. Another related concern is whether the results are sensitive to the inclusion of the immigrant inflow in 1921 in estimation. To deal with such concerns, I employ different forecasting techniques with and without the immigrant inflow in 1921 in estimation, including fractional polynomial curve-fitting, quadratic curve-fitting, and cubic curve-fitting. I also project the inflows using the pre-1914 10-year moving average and set the immigrant inflow at the fixed level in 1921. The projections are shown in the Online Appendix.

The estimates of the wage effect using instruments constructed from different forecasting techniques are presented in Table A5. The first-stage F-statistics are large and the coefficients on the foreign-born share from the county-level wage regressions are quite stable and insensitive to various forecasting methods, ranging from -1.1 to -1.6. The explanation is that the instrument is meant to capture the difference between the tight restriction on the Eastern and Southern European immigrants and the loose restriction on the Western and Northern European immigrants imposed by the quota system, which is not sensitive to different forecasting methods.

6.2 First-Stage Spurious Correlation

As discussed in section 4, the use of a same denominator in the dependent variable and explanatory variable in the first stage has the risk of a spurious correlation that is primarily driven by the variation of the denominator. This concern may be boosted by the robust results in Table A5 that the projections of excluded immigrants are irrelevant in the statistical significance in the first stage. To address this potential issue, I control for the reciprocal of the denominator in the first stage. In addition, note that in in Table A5 I construct Card (2001)'s shift-share instrument (by redistributing the immigrant inflows based on their historical settlement patterns) to run the 2SLS regressions. The results using the shift-share instrument can be regarded as a placebo

test: if it is truly the common denominator that yields the high correlation in the first stage, the shift-share instrument should appear to be a "good" instrument and produce a high F-statistic too. However, the corresponding first-stage F-statistic is only 3.2, which is incompatible with the speculation of a spurious correlation.[32]

Further I conduct a permutation test: to each US county I randomly assign number of excluded immigrants generated from a uniform distribution. The mean of the distribution is the same as the mean of estimated number of excluded immigrants from the fractional polynomial curve-fitting. Then I use the generated random number of excluded immigrants as the instrument in the 2SLS regressions and the resulting F-statistics are in general very small. The permutation test indicates that the nominator of the instrument (number of excluded immigrants) contains critical information that determines the first-stage statistical significance and the correlation is not spuriously driven by the shared denominator.

6.3 Falsification Test of Pre-Trends

Counties might have had different wage trends before the immigration quota system was established: if counties with more Eastern and Southern European immigrants had higher wage growths before the quotas and the wage trends persisted afterwards, the IV estimates may falsely capture the existing pre-trends of manufacturing wages. The same concern applies to the change in the black labor force share. To rule out this possibility, I conduct a falsification test by running the county-level regression of the following specification:

$$\Delta Y_{i1900-1920} = c_1 + \alpha_1 \frac{EI_i}{LF_{i1920}} + \Delta X_{i1900-1920}\beta_1 + \gamma_1 S_i + \omega_i \tag{8}$$

The dependent variable $\Delta Y_{i1900-1920}$ is the change in the natural log of wages and the change in the black labor force share between 1900 and 1920 (before the quotas). On the right hand side, the key explanatory variable is the "excluded immigrants" instrument, $\frac{EI_i}{LF_{i1920}}$. The covariates $\Delta X_{i1900-1920}$ include the changes in regional characteristics between 1900 and 1920,

[32]The low F-statistic of the shift-share instrument is a separate story: the probable explanation is that due to the immigration restriction, the inflows were in general low and the majority of them (especially Mexicans) were highly motivated by economic opportunities and did not conform to the ethnic-enclave clustering, upon which the shift-share instrument is built.

including the female labor force share, the urban labor force share, the age composition, and the industrial composition. S_i is the dummy for the South and ω_i is the error term.

As the reference, I also run regressions that are practically the reduced form of equations (1) and (2):

$$Y_{i1920-1930} = c_0 + \alpha_0 \frac{EI_i}{LF_{i1920}} + \Delta X_{i1920-1930}\beta_0 + \gamma_0 S_i + \omega_i \tag{9}$$

The falsification test is to assume that the policy shocks had happened between 1900-1920 and checks whether regional wage trends are correlated with the policy shocks as between 1920-1930. If counties had pre-quota wage trends that may contaminate the estimates, $\hat{\alpha}_1$ should show the same positive sign as $\hat{\alpha}_0$.

Table A6 presents the results of the falsification test. Columns 1 and 2 report the results of the wage regressions in the specifications of equations (8) and (9) respectively. Columns 3 and 4 report the results of the regressions using the black labor force share as the dependent variable in the specifications of equations (8) and (9). The results reject the null hypothesis of the existence of pre-trends. In column 1 the coefficient on the instrument is statistically significantly negative while the coefficient on the instrument in column 2 is positive and statistically significant. This implies that the pre-trends of wages are in fact opposite to the post-trends of wages. In columns 3-4 the results show that there are no significant pre-trends of the change in the black labor force share between 1900-1920 while excluded immigrants are positively correlated with the change in the black share between 1920-1930. Overall, the falsification test indicates that there are no pre-trends that bias the estimates.

6.4 Industry-Specific Demand Shock

Eastern and Southern European immigrants were relatively less skilled and less educated compared to Western and Northern European immigrants. It is possible that areas where Eastern and Southern Europeans concentrated had a greater share of industries that used unskilled labor intensively (e.g. textiles). If these industries experienced expansions between 1920 and 1930 that demanded more labor and drove up wages, the IV estimates may falsely capture local

demand shocks caused by the difference across regions' industrial structure.

First, I control for industry-specific trends in the industry-by-state-level analysis that accounts for industry-specific demand shocks. The coefficients on the foreign-born share still show strongly negative effects of immigrants on wages and salaries. To show the robustness of the results in the county-level regressions, I construct an index for local demand shocks at the county level caused by the different industrial compositions as follows:

$$\sum_j \frac{\Delta wage\_earners_{j1920-1930}}{\Delta wage\_earners_{1920-1930}} \times ind\_share_{ij1920} \tag{10}$$

$\frac{\Delta wage\_earners_{j1920-1930}}{\Delta wage\_earners_{1920-1930}}$ is the national change in the number of wage earners in industry j divided by the national change in the number of wage earners in the whole manufacturing sector between 1920 and 1930. It measures the relative change in labor demand in each industry. ind_share_{ij1920} is the employment share of industry j in county i in 1920. Thereby the whole index reflects the change in the labor demand condition in a county between 1920 and 1930 because of the overall expansion or decline of each industry at the national level and the difference in the industrial composition across counties.

As an alternative measure, the local demand shock is constructed as

$$\sum_j \frac{\Delta total\_empl_{j1920-1930}}{\Delta total\_empl_{1920-1930}} \times ind\_share_{ij1920} \tag{11}$$

where $total\_empl$ is the total employment in the industry (including both wage earners and salaried workers). I include the local demand shock in the 2SLS regressions and the estimates are reported in Table A7. In columns 1 and 2 the dependent variable is the change in the natural log of wages between 1920 and 1930 and in columns 3 and 4 the dependent variable is the change in the black labor force share between 1920 and 1930. In columns 1 and 3 the local demand shock is constructed in terms of the number of wage earners as in equation (10). In columns 2 and 4 the local demand shock is constructed in terms of the total employment in equation (11). The results are close to the estimates without controlling for the demand shocks, implying that the effects of immigrants on wages and the black labor force share are still robust after controlling for the local demand factors. The effects of the local demand shock on wages

and the black labor force shares are not statistically significant or statistically significant at 10% level.

7 Concluding Remarks

This paper studies the causal effects of immigration quotas on manufacturing wages, the Great Migration, and adjustments in manufacturing industrial production between 1920 and 1930. The immigration quota system in the 1920s assigned relatively large quotas to Western and Northern European countries and small quotas to Southern and Eastern European countries, which significantly restricted Eastern and Southern European immigrant inflows and only modestly restricted Western and Northern European immigrant inflows. Because immigrants tend to settle where previous immigrants of the same origin live and the historical settlement patterns of immigrants from different countries were highly heterogeneous, the quota system caused exogenous and differential immigrant labor supply shocks to different US regions.

I estimate the number of immigrants potentially excluded from each US region by the quotas and use it as the instrument for the change in a region's immigrant share between 1920 and 1930. The IV estimates show that the immigration restriction substantially increased manufacturing wages in this decade. A 1-percentage-point decline in the foreign-born share increased manufacturing wages on average by 1.4% at the county level. The estimates are robust to alternative forecasting techniques to construct the instrument and the negative wage effect cannot be attributed to the composition effect.

Regarding the comparison to the weak effects in the literature on the modern economy, there are a few possible explanations for the strong wage effect found in this study. First, the effect of immigration restriction or repatriation (that decreases labor supply) is likely asymmetric to the effect of immigrant inflows (that increases labor supply), especially when the continuous immigrant inflows are expected by employers. Second, the level of the factor market integration was much lower than today that allows factor mobility to reduce regional wage differentials (Rosenbloom, 1996). Third, immigrants primarily entered the manufacturing sector rather than the service sector today. Manufacturing jobs in this period were likely more homogeneous

and this may have prevented natives from specializing their job tasks and exploiting their comparative advantage in response to immigrant supply shocks (Peri and Sparber, 2009). As a result, low-skilled immigrants and natives were closer substitutes who intensely competed for homogeneous jobs and lowered wages.

I establish a clear causal relationship between the immigration restriction and the Great Migration in this decade, which provides further evidence on the "immigrant-as-deterrent" hypothesis (Thomas, 1972; Collins, 1997). The results show that the decline in the immigrant supply in a region encouraged a significant inflow of black migrants, which explained a substantial part of the Great Migration. The migrant groups who sought job opportunities opened up by the immigration restriction were primarily constituted by literate and young black workers who ended up with unskilled jobs in the North. These black migrants were likely close substitutes to the immigrant workers that had been largely excluded by the quota system. In this sense, the immigration restriction served as an important contributing factor to the Great Migration that "pulled" the blacks out of the South.[33]

I also find that manufacturers made adjustments in production after the immigrant labor supply had been curtailed by the quotas. At the intensive margin, the negative labor supply shock constrained the growth of establishment size in terms of both labor and capital. To cope with the labor shortage, there is weak evidence that manufacturers shifted towards more capital-intensive production utilizing traditional non-electrified machinery powered by water wheels, water turbines, and steam engines. On the other hand, the decline in the immigrant supply did not prompt the investment in machinery powered by electricity in production. Because of the lack of the unskilled immigrant labor supply, the immigration restriction stalled technology adoption of electrification that featured the transition to efficient labor-intensive mass production. Overall, the immigration restriction had a negative impact on the development of the US manufacturing sector by obstructing the growth of scale of production and discouraging technology progress.

[33]The Great Migration brought substantial economic gains to black migrants as well as a negative impact on their mortality (Collins and Wanamaker, 2014; Black et al., 2015).

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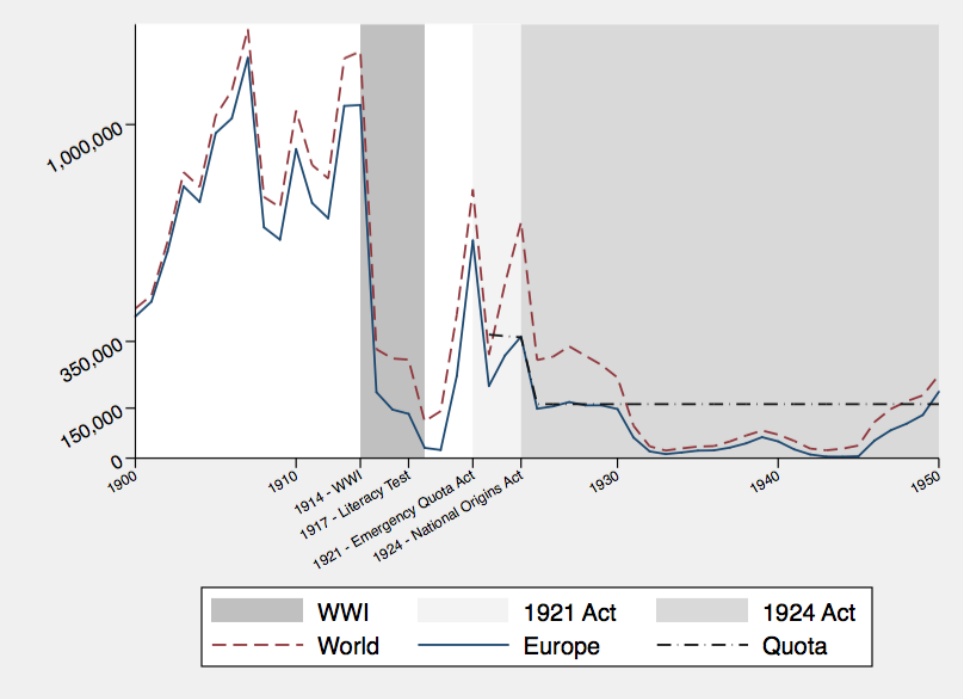
Figures and Tables

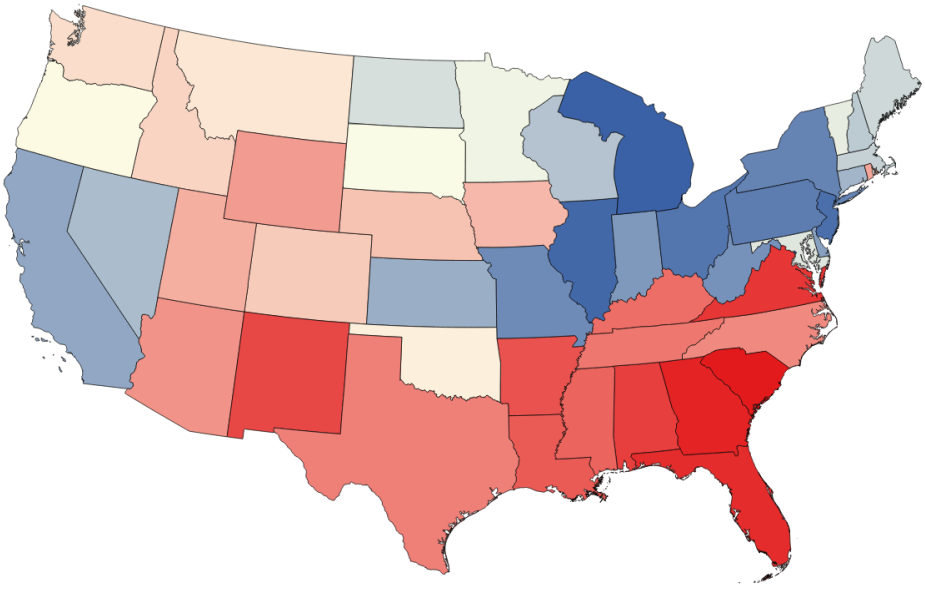
Figure 1: Annual Immigration to the US and Quotas



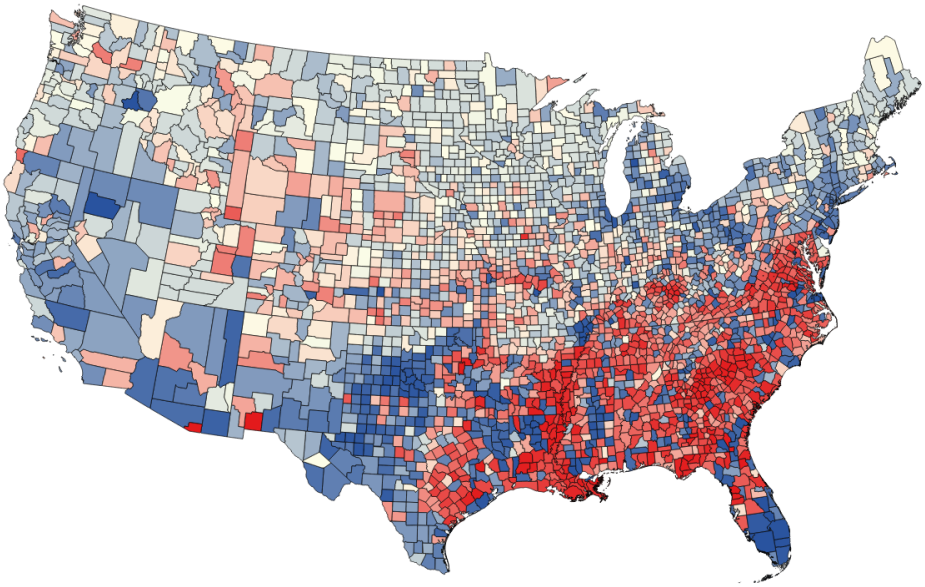
Red dashed line - Total (gross) immigration to the US; Blue solid line - European immigration to the US; Black dash-dotted line - Total immigration quota

Figure 2: The Great Migration

(a) Δ black labor force share 1920-1930 by state



(b) Δ black labor force share 1920-1930 by county



Darker red/blue: greater decline/increase in the black labor force share

Figure 3: Diagram - Migration Cycles and Quota System

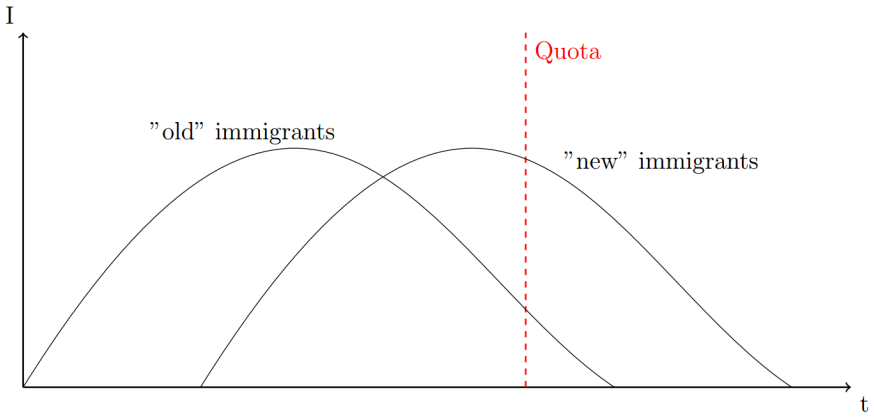
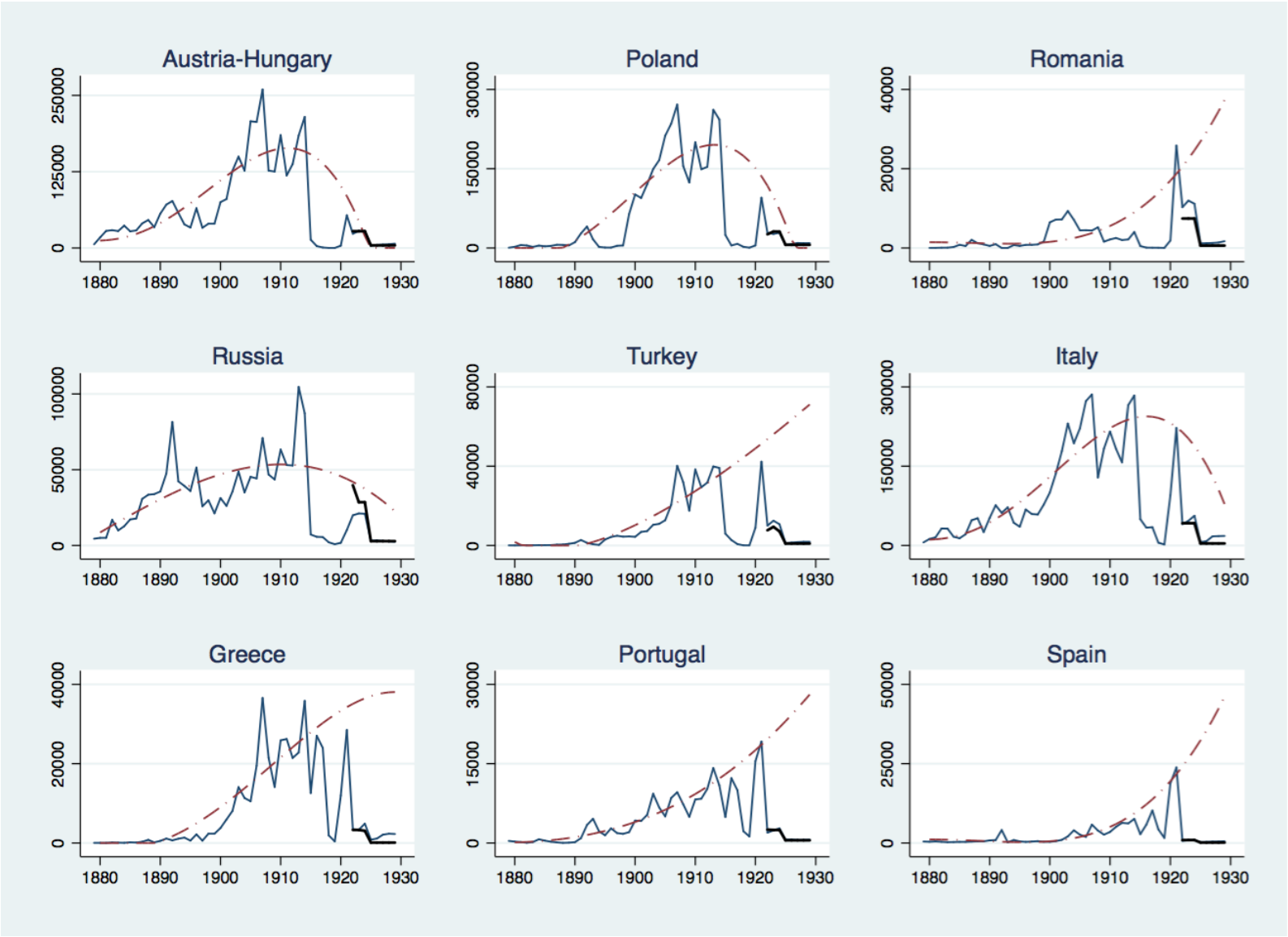
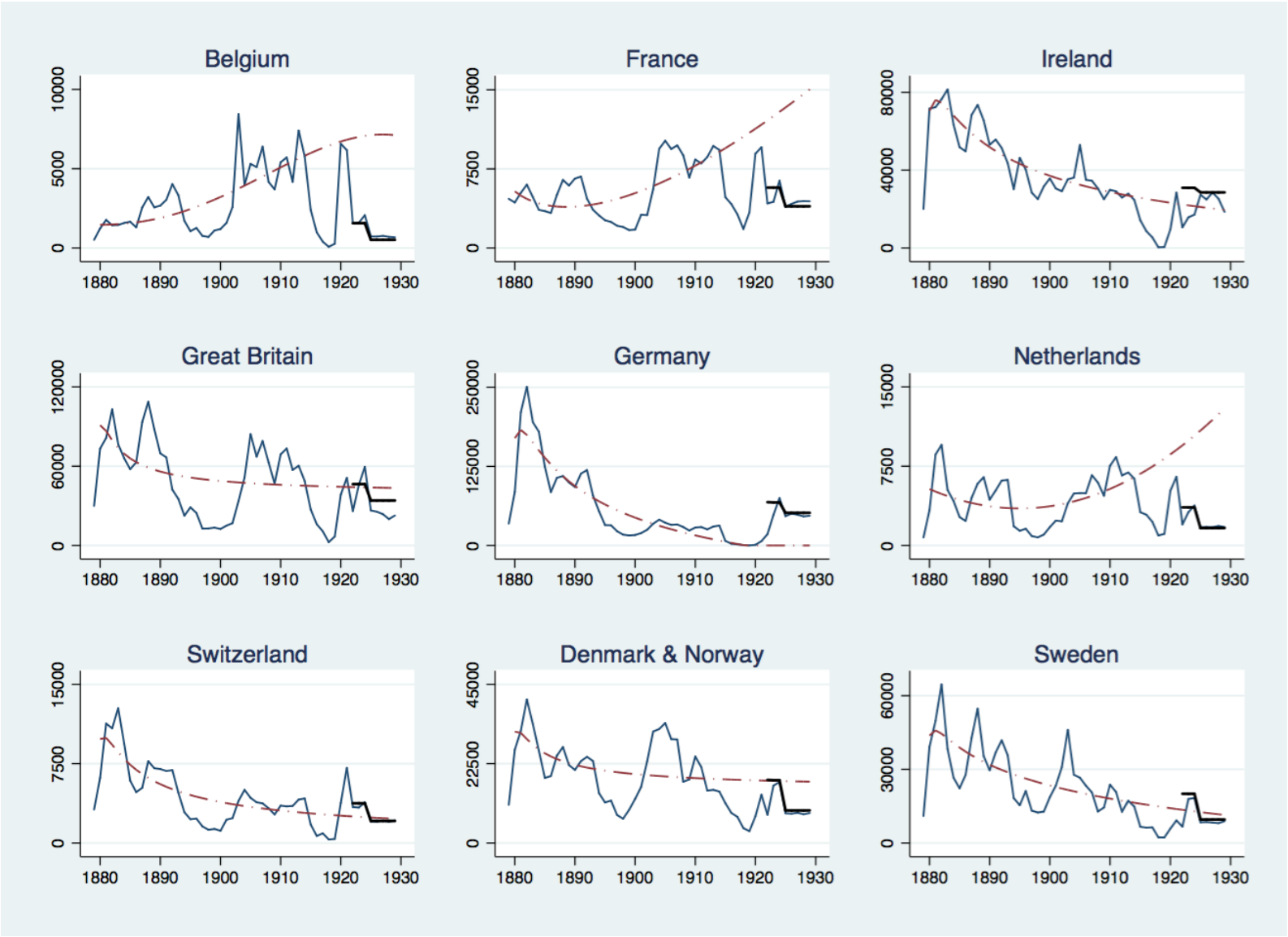


Figure 4: Projected Inflows, Actual Inflows, and Quotas by Country (1)



Red dash-dotted line - Projected inflows; Blue thin solid line - Actual inflows; Black thick solid line - Annual quotas

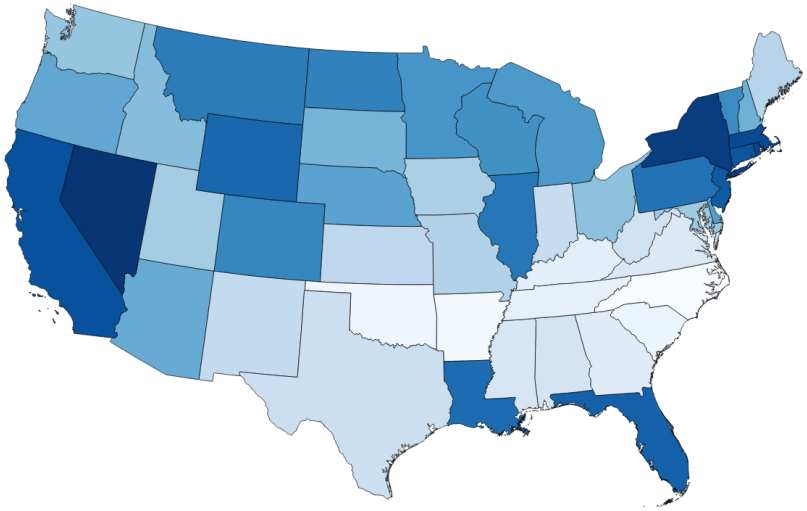
Figure 5: Projected Inflows, Actual Inflows, and Quotas by Country (2)



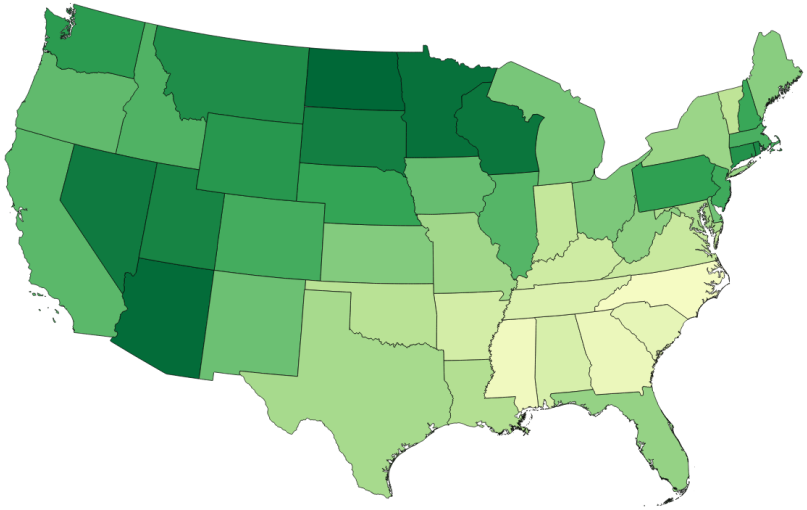
Red dash-dotted line - Projected inflows; Blue thin solid line - Actual inflows; Black thick solid line - Annual quotas

Figure 6: Excluded Immigrants (Normalized) and Change in the Foreign-Born Share (1)

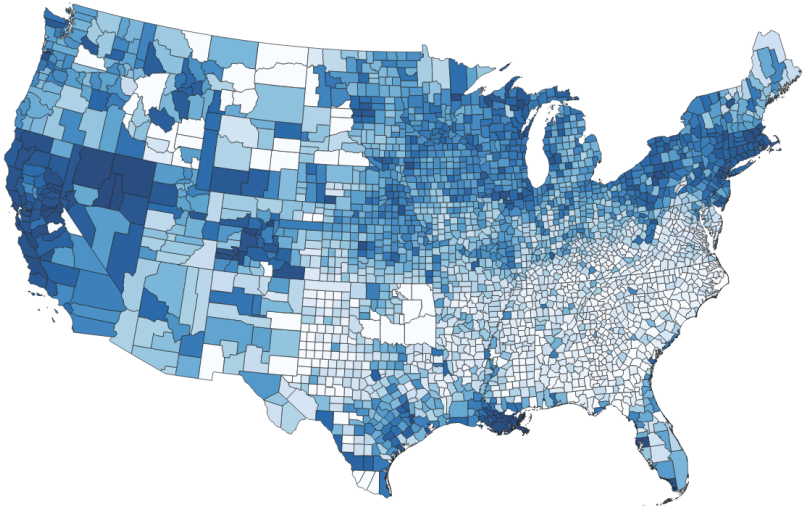
(a) Excluded immigrants/1920 labor force by state



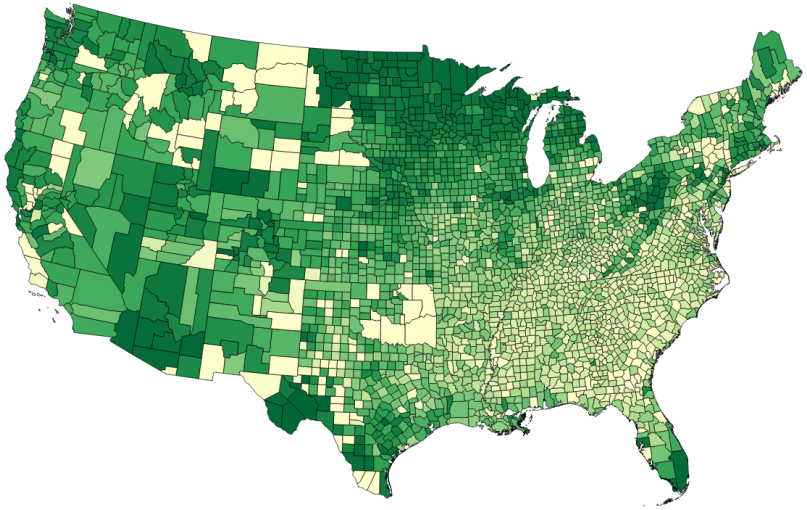
(b) Δforeign-born share 1920-1930 by state



(c) Excluded immigrants/1920 labor force by county



(d) Δforeign-born share 1920-1930 by county



Darker color: more excluded immigrants (normalized) in (a)(c); greater decline in the foreign-born share in (b)(d)

Figure 7: Excluded Immigrants (Normalized) and Change in the Foreign-Born Share (2)

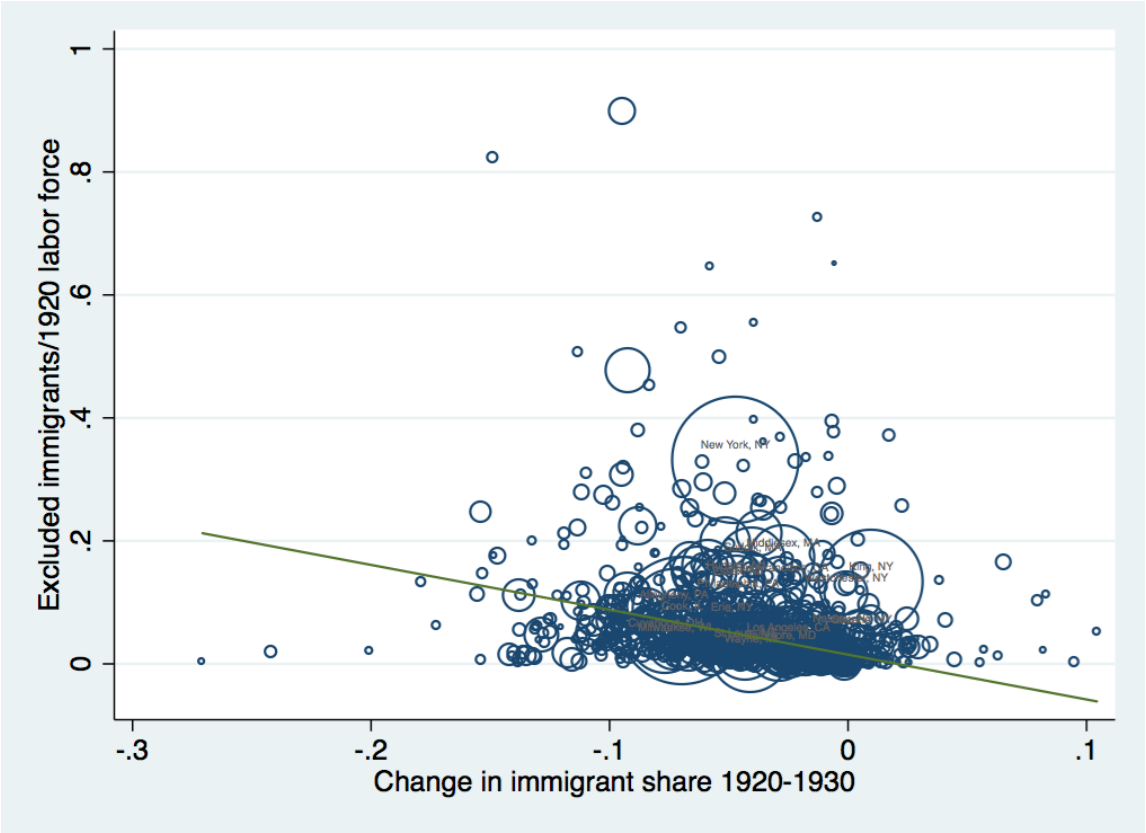
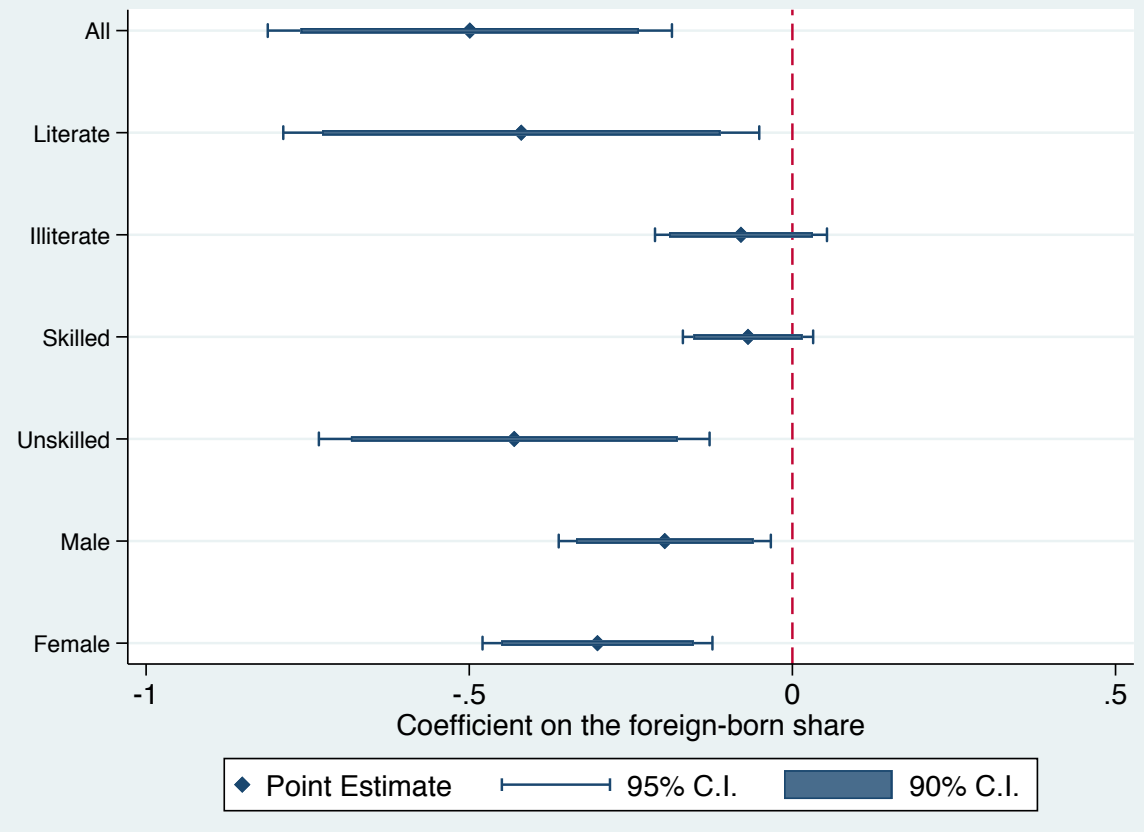


Figure 8: The Effects on Various Black Groups

(a) All Blacks



(b) Blacks Born in the South

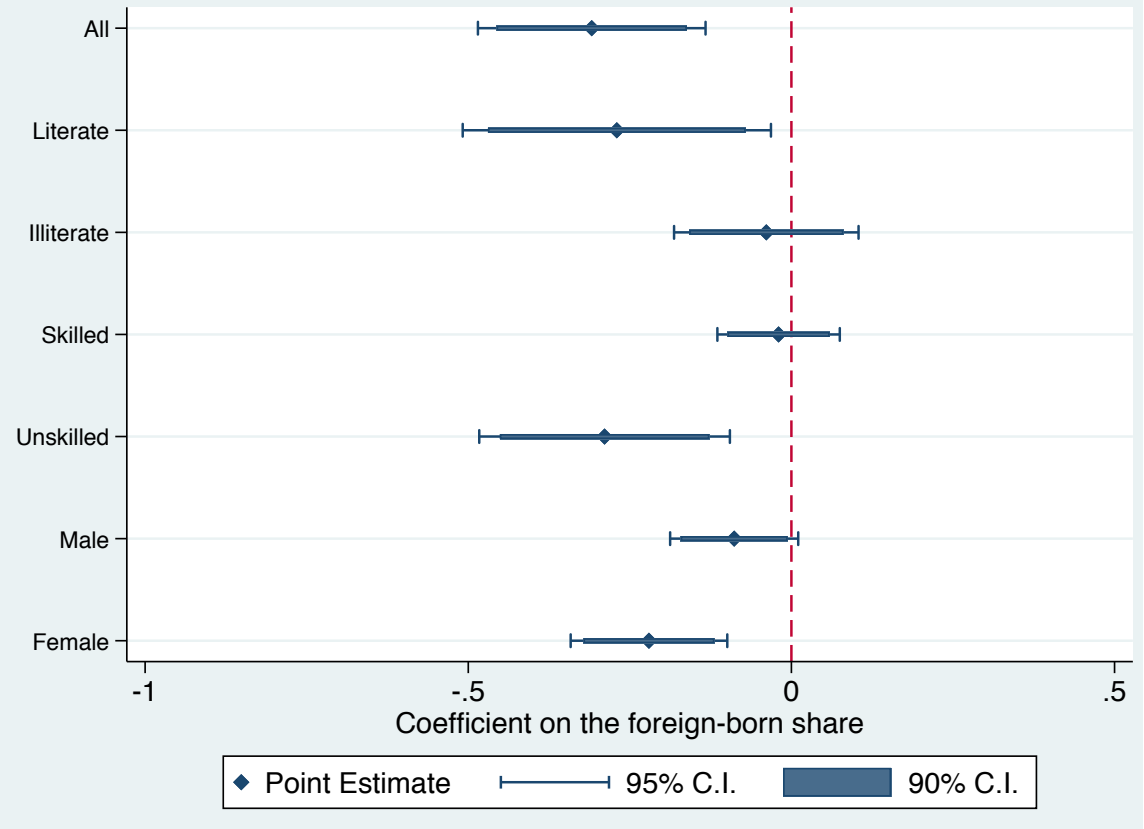
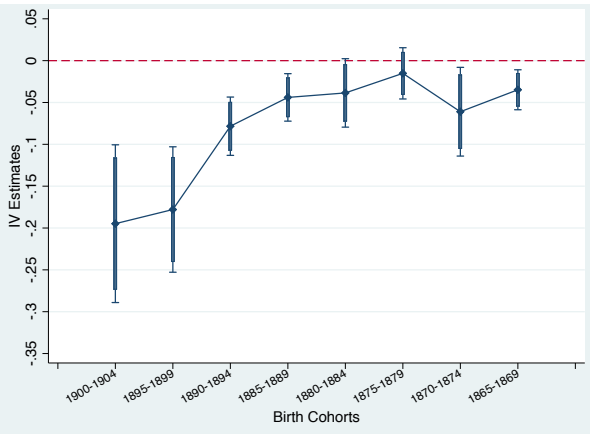
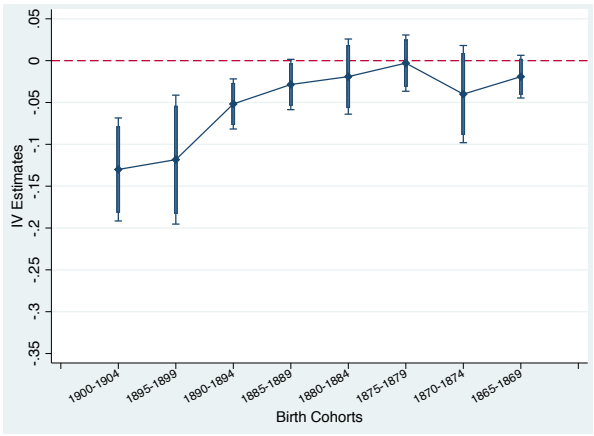


Figure 9: The Effects on Birth Cohorts

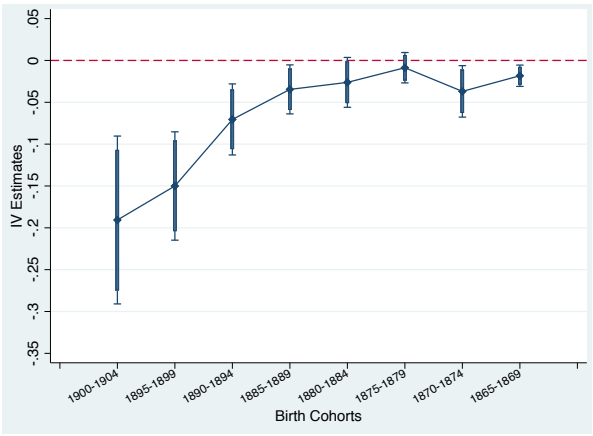
(a) All Blacks



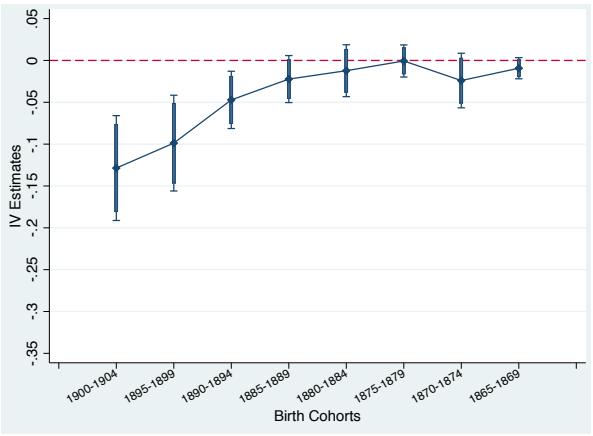
(b) Blacks Born in the South



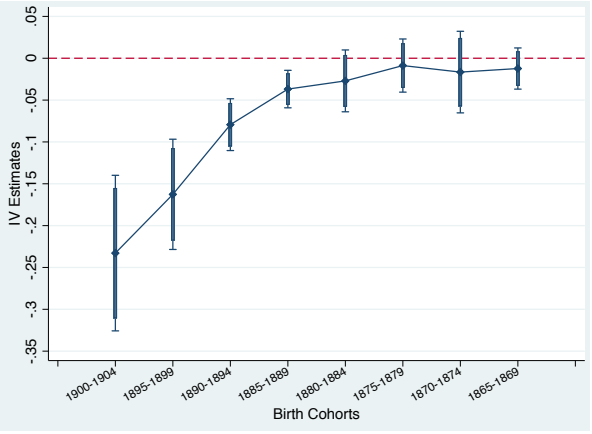
(c) All Literate Blacks



(d) Literate Blacks Born in the South



(e) All Unskilled Blacks



(f) Unskilled Blacks Born in the South

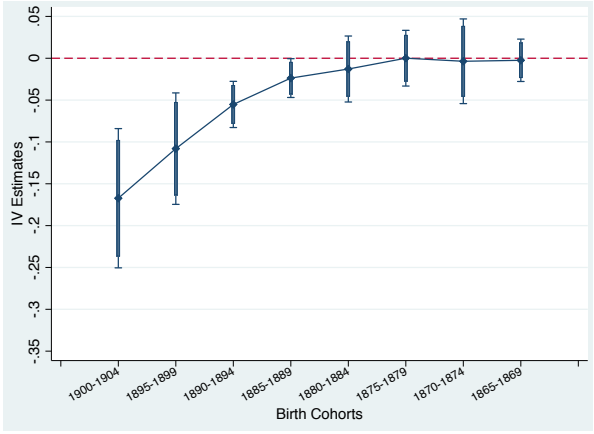


Table 1: Summary Statistics

	All		North		South	
	1920	1930	1920	1930	1920	1930
Manufacturing wage ($/year)	1158	1334	1193	1409	924	911
	(217)	(283)	(197)	(210)	(199)	(275)
Manufacturing salary ($/year)	1999	2677	2008	2711	1913	2386
	(116)	(205)	(114)	(185)	(113)	(115)
Labor Force Structure (%)						
Foreign-born	19.8	16.8	25.2	21.5	3.6	2.8
Black	10.7	10.7	3.4	4.2	32.8	30.1
Female	21.1	23.1	21.1	23.1	21.0	23.0
Literate	93.5	95.5	96.2	97.6	85.1	89.4
Urban	52.8	57.7	63.3	67.2	25.4	32.2
Agriculture	22.6	18.4	15.3	12.1	44.7	37.3
Manufacturing	18.7	17.2	21.0	18.8	11.7	12.4
Manufacturing Industrial Characteristics						
Wage earners per establishment	31.7	41.9	33.3	42.7	24.0	37.9
	(23.6)	(29.6)	(23.9)	(28.9)	(20.8)	(32.4)
Horsepower per establishment	102.0	203.1	104.1	204.9	92.4	193.7
	(126.7)	(270.7)	(131.2)	(276.1)	(102.4)	(241.9)
Horsepower per wage worker	3.2	4.8	3.1	4.8	3.9	5.1
	(2.4)	(3.4)	(2.4)	(3.4)	(2.2)	(3.2)
Value added per wage worker	2755	3610	2834	3791	2231	2582
	(710)	(1214)	(637)	(980)	(917)	(1776)
Salaried worker to wage worker ratio	0.16	0.15	0.17	0.16	0.11	0.10
	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)
Electrification ratio (%)	32.0	53.1	33.3	53.7	25.3	49.7
Manufacturing Industrial Composition (%)						
Food and kindred products	9.4	9.2	9.4	9.2	8.8	8.9
Textiles and their products	17.0	18.4	16.7	16.8	19.4	27.6
Forest products	9.4	9.9	6.4	7.0	29.6	26.2
Paper and allied products	2.2	2.7	2.5	3.0	0.5	0.9
Printing and publishing	4.5	6.0	4.6	6.3	3.3	4.0
Chemical and allied products	3.5	3.0	3.2	2.7	5.6	4.5
Products of petroleum and coal	1.4	1.7	1.4	1.5	1.9	2.7
Rubber products	1.9	1.5	2.2	1.7	0.0	0.0
Leather products	4.0	3.6	4.4	4.1	1.0	0.9
Stone, clay, and glass products	3.3	3.6	3.1	3.5	4.1	4.1
Iron and steel and their products	9.3	9.5	10.1	10.5	3.7	4.3
Nonferrous metals	2.9	3.2	3.3	3.7	0.7	0.7
Machinery	12.3	12.9	13.6	14.7	3.8	2.8
Transportation equipment	8.2	6.3	8.9	7.2	3.7	1.3
Railroad repair shops	5.5	4.5	4.9	4.0	9.1	7.6
Miscellaneous industries	5.3	4.1	5.4	4.2	4.8	3.6
States	49	49	35	35	14	14
Counties	2330	2330	1338	1338	992	992

Note: The sample is 2330 counties in 48 states (excluding Hawaii and Alaska) and D.C. The North (non-South) include 1338 counties in 34 states and D.C. The South includes 992 counties in 14 states. "Electrification ratio" is measured as the electric horsepower to total horsepower ratio in the manufacturing sector. "Manufacturing industrial composition" is the employment shares of all 2-digit manufacturing industries. Standard deviations are reported in parentheses.

Table 2: The Impact on Manufacturing Wages: County-level First Difference 1920-1930

	WLS				2SLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep Var: Δln(wage)								
Foreign-born share	-0.409	-0.757*	-0.163	-0.125	-3.141*	-2.333**	-1.720*	-1.441**
	(0.528)	(0.400)	(0.273)	(0.250)	(1.817)	(1.120)	(0.914)	(0.565)
Female share		-1.296***	-1.054***	-1.102***		-1.083***	-0.924***	-1.002***
		(0.367)	(0.303)	(0.266)		(0.312)	(0.274)	(0.260)
Urban share		-0.347***	-0.105	-0.090		-0.365**	-0.194	-0.155
		(0.118)	(0.126)	(0.117)		(0.168)	(0.168)	(0.127)
Southern economy			-0.182***	-0.167***			-0.137***	-0.131***
			(0.029)	(0.026)			(0.026)	(0.023)
					First stage			
Excluded immigrants					-0.076***	-0.086***	-0.081***	-0.088***
					(0.025)	(0.016)	(0.015)	(0.012)
Cragg-Donald F-Stats					93.2	343.5	305.3	353.1
Kleibergen-Paap rk F-Stats					9.5	29.9	30.0	55.2
1/labor force in 1920					✓	✓	✓	✓
Age composition		✓	✓	✓		✓	✓	✓
MFG. industrial composition				✓				✓

Note: Columns 1-4 report the estimates from the WLS regressions. Columns 5-8 report the estimates from the 2SLS regressions using the "excluded immigrants" instrument. The sample is 2330 counties in all 48 states and D.C. The dependent variable is the change in the natural log of the average manufacturing wage between 1920 and 1930. "Southern economy" is a dummy that indicates if the county belongs to the South. "Age composition" is the labor force shares of 4 age groups (16-24; 25-34; 35-44; 45-54). "Manufacturing industrial composition" is the labor force shares of 15 2-digit industries ("Miscellaneous industries" omitted due to collinearity). **All control variables except the "Southern economy" dummy and 1/labor force in 1920 are first-differenced.** The lower panel reports the estimates and the F-statistics from the first-stage regressions. Cragg-Donald Wald F-stats and Kleibergen-Paap Wald F-stats are reported. "Excluded immigrants" is the total number of excluded immigrants between 1920 and 1930 divided by the county's labor force size in 1920. Standard errors clustered by state are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table 3: The Impact on Wages and Salaries: Industry-by-State-Level First Difference 1920-1930

	2-Digit Industry by State			4-Digit Industry by State		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel.A - Dep Var: Δln(wage)						
Foreign-born share	-3.822***	-3.243***	-3.269***	-2.240***	-1.523**	-1.511*
	(0.763)	(1.077)	(1.266)	(0.715)	(0.698)	(0.858)
Southern economy		-0.050	-0.052		-0.071***	-0.073***
		(0.048)	(0.053)		(0.019)	(0.027)
Panel.B - Dep Var: Δln(salary)						
Foreign-born share	-3.026***	-3.515**	-3.413**	-1.480***	-2.324**	-2.365**
	(0.969)	(1.497)	(1.595)	(0.519)	(0.953)	(1.162)
Southern economy		0.043	0.041		0.083	0.083
		(0.052)	(0.054)		(0.054)	(0.060)
1/labor force in 1920, age, female, urban	✓	✓	✓	✓	✓	✓
Industry-specific trend			✓			✓
Observations	628	628	628	3180	3180	3180

Note: The table reports the estimates from the 2SLS regressions. The sample in columns 1-3 is 628 state-specific 2-digit manufacturing industries and the sample in columns 4-6 is 3180 state-specific 4-digit manufacturing industries. "Age composition" is the labor force shares of 4 age groups (16-24; 25-34; 35-44; 45-54). "Female" is the female labor force share. "Urban" is the urban labor force share. **All control variables except the dummies and 1/labor force in 1920 are first-differenced.** Standard errors two-way clustered by state and industry are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table 4: The Impact on the Great Migration: County-Level First Difference 1920-1930

	WLS			2SLS			
			All			North	South
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel.A - Dep Var: Δlabor force share of all native blacks							
Foreign-born share		-0.122***	-0.155***	-0.539	-0.499***	-0.373**	-0.435***
		(0.042)	(0.037)	(0.427)	(0.160)	(0.167)	(0.115)
Southern economy	-0.029***	-0.025***	-0.020***	-0.012	-0.013***		
	(0.004)	(0.004)	(0.004)	(0.011)	(0.004)		
Migrant stock in 1920			0.150**		0.171**	0.159**	
			(0.066)		(0.072)	(0.062)	
Panel.B - Dep Var: Δlabor force share of blacks born in the South							
Foreign-born share		-0.103***	-0.126***	-0.269	-0.309***	-0.183*	-0.342**
		(0.040)	(0.034)	(0.252)	(0.090)	(0.104)	(0.135)
Southern economy	-0.024***	-0.021***	-0.016***	-0.015**	-0.013***		
	(0.005)	(0.005)	(0.004)	(0.007)	(0.004)		
Migrant stock in 1920			0.143***		0.157***	0.150***	
			(0.052)		(0.054)	(0.049)	
1/labor force in 1920				✓	✓	✓	✓
Age comp., female, urban			✓		✓	✓	✓
MFG. industrial composition			✓		✓	✓	✓
Observations	2330	2330	2330	2330	2330	1338	992

Note: Columns 1-3 report the estimates from the WLS regressions. Columns 4-7 report the estimates from the 2SLS regressions using the "excluded immigrants" instrument. The sample in columns 1-5 is all 2330 counties. The sample in columns 6 is 1338 counties in the North and the sample in columns 7 is 992 counties in the South. "Age composition" is the labor force shares of 4 age groups (16-24; 25-34; 35-44; 45-54). "Female" is the female labor force share. "Urban" is the urban labor force share. "Manufacturing industry composition" is the labor force shares of 15 2-digit manufacturing industries ("Miscellaneous industries" omitted due to collinearity). **All control variables except the South dummy, 1/labor force in 1920, and the migrant stock in 1920 are first-differenced.** Standard errors clustered by state are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table 5: The Impact on Industrial Production: County-Level First Difference 1920-1930

	WLS		2SLS				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel.A - Dep Var: Δln(wage workers per establishment)							
Foreign-born share	2.552***	2.010***	10.292***	8.891***	6.449***	10.811***	7.862***
	(0.658)	(0.475)	(3.708)	(2.420)	(1.806)	(2.789)	(2.080)
Southern economy		-0.026				-0.207***	-0.169***
		(0.044)				(0.064)	(0.052)
Panel.B - Dep Var: Δln(horsepower per estab.)							
Foreign-born share	-0.019	0.774	8.156*	6.512*	5.063*	9.202**	7.099**
	(0.504)	(0.488)	(4.772)	(3.479)	(2.634)	(4.260)	(3.134)
Southern economy		-0.137***				-0.289***	-0.243***
		(0.048)				(0.089)	(0.076)
Panel.C - Dep Var: Δln(horsepower per wage worker)							
Foreign-born share	-2.571***	-1.235**	-2.136	-2.379	-1.386	-1.609	-0.763
	(0.686)	(0.553)	(1.699)	(1.594)	(1.395)	(1.971)	(1.639)
Southern economy		-0.111***				-0.083	-0.074*
		(0.032)				(0.055)	(0.044)
Panel.D - Dep Var: Δln(value added per wage worker)							
Foreign-born share	-1.449**	-0.615	-2.722	-2.388**	-1.999**	-0.513	-0.530
	(0.713)	(0.393)	(1.685)	(1.183)	(1.020)	(1.034)	(0.926)
Southern economy		-0.185***				-0.202***	-0.175***
		(0.030)				(0.042)	(0.030)
1/labor force in 1920			✓	✓	✓	✓	✓
Age comp., female, urban		✓		✓	✓	✓	✓
MFG. industrial composition		✓			✓		✓

Note: Columns 1-2 report the estimates from the WLS regressions. Columns 3-7 report the estimates from the 2SLS regressions using the "excluded immigrants" instrument. The sample is all 2330 counties. "Age composition" is the labor force shares of 4 age groups (16-24; 25-34; 35-44; 45-54). "Female" is the female labor force share. "Urban" is the urban labor force share. "Manufacturing industry composition" is the labor force shares of 15 2-digit manufacturing industries ("Miscellaneous industries" omitted due to collinearity). **All control variables except the South dummy and 1/labor force in 1920 are first-differenced.** Standard errors clustered by state are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table 6: The Impact on Industrial Production: Industry-by-State-Level First Difference 1920-1930

	Dependent Variable (First-Differenced, Columns 1-5 in Log Form)						
	Establishment Size		Capital Intensity	Labor Productivity	Electrification		Skill Intensity
	Wage workers per estab.	Horsepower per estab.	Horsepower per wage worker	Valued added per wage worker	Electric HP per wage worker	Electric HP to total HP ratio	Salaried worker to wage worker ratio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel.A - 2-digit industry							
Foreign-born share	14.761**	7.084	-7.677**	-1.323	4.694	2.988*	-1.248**
	(6.139)	(4.362)	(3.537)	(1.308)	(4.061)	(1.574)	(0.575)
Observations	628	628	628	628	628	628	628
Panel.B - 4-digit industry							
Foreign-born share	8.999***	5.374***	-3.625***	-2.304	13.055**	2.054**	-1.209**
	(3.099)	(1.846)	(1.195)	(1.537)	(6.026)	(0.987)	(0.480)
Observations	3180	3180	3180	3180	3180	3180	3180

Note: The table reports the estimates from the 2SLS regressions. The sample in Panel A is 628 2-digit industries in all states and D.C. and the sample in Panel B is 3180 4-digit industries in all states and D.C. The control variables include the female labor force share, the urban labor force share, the age composition, the South dummy, 1/labor force in 1920, and industry-specific trends (industry dummies). **All control variables except the dummies and 1/labor force in 1920 are first-differenced.** Standard errors two-way clustered by state and industry are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Appendix I: Data

Two-Digit Industries

The 4-digit industries reported in Censuses of Manufactures are grouped into 16 broad categories of 2-digit industries that are consistent in 1919 and 1929: (1) Food and Kindred Products; (2) Textiles and Their Products; (3) Forest and Wood Products; (4) Paper and Allied Products; (5) Printing, Publishing, and Allied Industries; (6) Chemical and Allied Products; (7) Petroleum and Coal Products; (8) Rubber Products; (9) Leather and Its Manufactures; (10) Stone, Clay, and Glass Products; (11) Iron and Steel and Their Products; (12) Nonferrous Metals and Their Products; (13) Machinery, Not Including Transportation Equipment; (14) Transportation Equipment, Air, Land, and Water; (15) Railroad Repair Shops; (16) Miscellaneous Industries.

Harmonization of Countries

Austria, Hungary, and Czechoslovakia are merged as "Austria-Hungary". Germany and Luxembourg are merged as "German Empire". Yugoslavia (Kingdom of Serbs, Croats, and Slovenes), Albania, Bulgaria, Asian Turkey and European Turkey are merged as "Turkey" (Ottoman Empire). Russia, Armenia, Estonia, Finland, Latvia, Lithuania are merged as "Russian Empire". England, Scotland, Wales are merged as "Great Britain".

Skilled and Unskilled Occupations

Skilled and unskilled occupations are defined based on the 1950 Census Bureau occupation classification (https://usa.ipums.org/usa-action/variables/OCC1950#codes_section). Skilled occupations are occupations of code under 600 that include broad categories of "Professional, Technical", "Farmers (owners, tenants, and managers)", "Managers, Officials, and Proprietors", "Clerical and Kindred", "Sales Workers", and "Craftsmen". Unskilled occupations are defined as occupations of code over 600 and under 970 that include broad categories of "Operatives", "Service Workers (private household)", "Service Workers (not household)",

"Farm Laborers", "Laborers". Refer to the Online Appendix for detailed classifications of skilled and unskilled occupations.

Construction and Availability of Variables

Table A1: List of Variables and Sources

Variables	County Level	Industry-by-state Level	State Level	Source
Statistics				
(1). Manufacturing wage bill	✓	✓		a
(2). Manufacturing salary bill		✓		a
(3). Value added of products	✓	✓		a
(4). Total horsepower	✓	✓		a
(5). Horsepower powered by electricity		✓		a
(6). Number of establishments	✓	✓		a
(7). Number of wage workers	✓	✓		a
(8). Number of salaried workers		✓		a
Variables Constructed				
Average manufacturing wage	✓	✓		(1)/(7)
Average manufacturing salary	✓	✓		(2)/(8)
Wage workers per establishment	✓	✓		(7)/(6)
Horsepower (HP) per wage worker	✓	✓		(4)/(7)
Electric HP per wage worker		✓		(5)/(7)
Electric to total HP ratio		✓		(5)/(4)
Value added per wage worker	✓	✓		(3)/(7)
Manufacturing employment share	✓	✓		a, b
Foreign-born labor force share	✓		✓	b
Female labor force share	✓		✓	b
Black labor force share	✓		✓	b
Urban labor force share	✓		✓	b
Historical immigrant stock	✓		✓	c

a. Censuses of Manufactures, 1919 and 1929
b. IPUMS 100% Census microsamples, 1920 and 1930
c. Census of Population, 1900

Appendix II: Additional Figures and Tables

Table A2: Annual Quotas in the 1921 Act and the 1924 Act by Country

Country of Birth	1921	1922[1]	1924
Albania	288	288	100
Armenia	1,589	230	124
Austria	7,451	7,451	785
Belgium	1,563	1,563	512
Bulgaria	302	302	100
Czechoslovakia	14,282	14,357	3,073
Danzig, Free City of	301	301	228
Denmark	5,694	5,619	2,789
Estonia	-	1,348	124
Finland	3,921	3,921	471
France	5,729	5,729	3,954
Germany	68,059	67,607	51,227
Great Britain	46,405	46,405	34,007
Greece	3,294	3,294	100
Hungary	5,638	5,638	473
Iceland	-	75	100
Ireland (Irish Free State)	30,937	30,937	28,567
Italy	42,057	42,057	3,845
Latvia	-	1,540	142
Lithuania	-	2,460	344
Luxemburg	92	92	100
Netherlands	3,607	3,607	1648
Norway	12,202	12,202	6,453
Poland	25,827	31,146	5982
Portugal	2,520	2,465	503
Romania (Rumania)	7,419	7,419	603
Russia	34,284	24,405	2,248
Spain	912	912	131
Sweden	20,042	20,042	9,561
Switzerland	3,752	3,752	2,081
Yugoslavia	6,426	6,426	671
Palestine	56	57	100
Syria	906	882	100
Turkey	656	2,388	100
Australia	279	279	121
New Zealand and Pacific Islands	80	80	100
All Others	425	527	3,100
Total	356,995	357,803	164,667

[1]The Emergency Quota Act of 1921 expired on June 30, 1922 and was extended for two years with some minor revisions.

Source: *Annual Report of the Commissioner General of Immigration* (1924), pp.7, Table II&pp.26-27.

Table A3: Annual Immigrant Inflow 1900-1909 and Quotas by Country

	(1) Pre-WWI inflow	(2) 1921 Quota	(3) 1924 Quota	(4) (2)/(1)	(5) (3)/(1)
Eastern Europe					
Austria-Hungary	154,964	27,446	4,961	17.7%	2.8%
Poland	175,723	25,827	5,982	14.7%	3.4%
Romania	4,678	7,419	603	158.6%	12.9%
Russian Empire	52,579	39,794	2,843	75.7%	5.4%
Turkey	22,734	7,672	971	33.7%	4.3%
Southern Europe					
Greece	8,507	3,294	100	17.8%	0.5%
Italy	202,353	42,057	3,825	20.8%	2.0%
Portugal	7,804	2,520	503	32.3%	6.4%
Spain	3,563	912	131	25.6%	3.7%
Western Europe					
Belgium	4,724	1,563	512	33.1%	10.8%
France	7,449	5,729	3,954	76.9%	53.1%
German Empire	28,980	67,699	51,327	236.2%	177.9%
Netherlands	5,214	3,607	1,648	69.2%	31.6%
Switzerland	3,423	3,752	2,081	109.6%	60.8%
Northern Europe					
Great Britain	51,869	46,405	34,007	89.5%	65.6%
Ireland	32,157	30,937	28,567	96.2%	88.8%
Denmark	6,313	5,619	2,789	90.2%	44.2%
Norway	15,974	12,202	6,453	76.4%	40.4%
Sweden	22,244	20,042	9,561	90.1%	43.0%

Note: Column 1 lists the average annual immigrant inflow between 1900-1914 from each European country. Column 2 lists the quotas assigned to each European country by the Emergency Quota Act of 1921. Column 3 lists the quotas assigned to each European country by the Quota Act of 1924. Column 4 lists the 1921 quota in column 2 divided by the average annual immigrant inflow in column 1. Column 4 lists the 1924 quota in column 3 divided by the average annual immigrant inflow in column 1.
Source: *Annual Report of Commissioner-General of Immigration*, Various Years.

Table A4: Top 3 States and Counties of Immigrants' Residence by Country in 1900

	States						Counties					
	1st	%	2nd	%	3rd	%	1st	%	2nd	%	3rd	%
Eastern Europe												
Austria-Hungary	NY	22.8	PA	20.4	IL	11.0	New York, NY	18.2	Cook, IL	9.4	Cuyahoga, OH	5.1
Poland	PA	19.8	NY	18.1	IL	17.6	Cook, IL	16.3	New York, NY	5.5	Erie, NY	5.2
Romania	NY	70.1	PA	8.4	MN	3.2	New York, NY	63.5	Philadelphia, PA	6.9	Kings, NY	6.2
Russian Empire	NY	34.8	PA	10.7	MA	6.6	New York, NY	27.2	Philadelphia, PA	6.0	Kings, NY	5.4
Turkey	MA	29.1	NY	19.3	CA	6.5	New York, NY	18.2	Worcester, MA	11.8	Suffolk, MA	8.9
Southern Europe												
Greece	MA	21.3	NY	18.2	IL	18.1	Cook, IL	17.5	Middlesex, MA	15.5	Suffolk, MA	3.2
Italy	NY	37.6	PA	13.8	NJ	8.6	New York, NY	21.5	Kings, NY	7.7	Philadelphia, PA	3.7
Portugal	MA	36.2	CA	32.5	RI	6.9	Bristol, MA	25.4	Alameda, CA	7.3	Middlesex, MA	4.0
Spain	NY	22.2	FL	14.9	CA	12.3	Hillsborough, FL	13.7	Orleans, LA	6.5	San Francisco, CA	3.3
Western Europe												
Belgium	WI	14.8	IL	14.7	PA	13.8	Brown, WI	7.8	Cook, IL	4.3	Allegheny, PA	3.7
France	NY	19.1	CA	11.7	PA	8.8	New York, NY	10.6	San Francisco, CA	4.8	Orleans, LA	4.3
German Empire	NY	18.0	IL	12.5	WI	9.1	Cook, IL	7.1	New York, NY	7.1	Kings, NY	3.8
Netherlands	MI	28.9	IL	20.9	NJ	9.8	Cook, IL	18.7	Kent, MI	12.7	Passaic, NJ	6.9
Switzerland	NY	11.8	OH	10.4	CA	9.5	New York, NY	5.1	Cook, IL	3.1	St Louis, MO	2.4
Northern Europe												
Great Britain	PA	15.4	NY	15.1	MA	9.3	New York, NY	4.1	Philadelphia, PA	4.0	Cook, IL	3.9
Ireland	NY	26.3	MA	15.4	PA	12.7	New York, NY	11.1	Philadelphia, PA	6.1	Kings, NY	5.2
Denmark&Norway	MN	24.6	WI	15.8	IL	9.3	Cook, IL	6.9	Hennepin, MN	2.8	Kings, NY	2.2
Sweden	MN	20.1	IL	17.3	NY	7.4	Cook, IL	9.2	Hennepin, MN	3.7	Kings, NY	2.6

Note: The table shows the top 3 states and counties with highest proportions of immigrants from each European sending country. The percentage is calculated as the number of immigrants from a country living in the state or county divided by the total number of immigrants from the same country in the US. For instance, column 1 row 1 indicates 22.8% of immigrants from Austria-Hungary live in New York state in 1900.
Source: *Census of Population*, 1900

Table A5: The IV Estimates Using Different Forecasting Techniques

Dependent Variable: Δln(wage)			
Forecasting Method	Include 1921?	Coefficient (S.E.)	F-stats
a. Fractional polynomial curve-fitting	Yes	-1.441**	55.1
		(0.565)	
	No	-1.027*	102.9
		(0.571)	
b. Cubic curve-fitting	Yes	-1.465**	59.8
		(0.629)	
	No	-1.578*	43.9
		(0.594)	
c. Quadratic curve-fitting	Yes	-1.089*	70.9
		(0.653)	
	No	-1.035	110.3
		(0.676)	
d. Pre-1914 10-year moving average		-1.118	65.6
		(0.704)	
e. Fixed at 1921 level		-1.301**	33.5
		(0.649)	
f. Shift-share instrument (Card, 2001)		-0.161	3.2
		(1.031)	

Note: The table reports the estimates from the 2SLS regressions using instruments constructed from different forecasting techniques. The regression specification is the same as Table 2 column 8. The instruments in row a-c are predicted using fractional polynomial curve-fitting (with/without 1921 inflow), cubic curve-fitting (with/without 1921 inflow), quadratic curve-fitting (with/without 1921 inflow). The instrument in row d uses the 10-year moving average of pre-1914 to predict post-1921 level. The instrument in row e is to assume the post-1921 inflow is fixed at the 1921 level. The instrument in row f is the shift-share instrument constructed in the way identical to Card (2001). Standard errors clustered by state are reported in parentheses.

*p<0.1, **p<0.05, ***p<0.01.

Table A6: Falsification Test of Pre-Trends

Dependent Variable:	Δln(wage)		Δblack L.F. share	
	1900-1920 (1)	1920-1930 (2)	1900-1920 (3)	1920-1930 (4)
Excluded immigrants 1920-1930	-0.224***	0.127***	-0.016	0.041***
	(0.075)	(0.047)	(0.016)	(0.014)
X: Age composition, female labor force share, urban labor force share, industrial composition				
ΔX 1900-1920	✓		✓	
ΔX 1920-1930		✓		✓
Southern economy	✓	✓	✓	✓
Observations	2205	2330	2215	2330

Note: The table reports the estimates from the WLS regressions of equations (8) and (9). The results in columns 1 and 3 are estimated using the specification of equation (8). The dependent variables in columns 1 and 3 are the change in the natural log of wages and the change in the black labor force share between 1900 and 1920 respectively. The results in columns 2 and 4 are estimated using the specification of equation (9). The dependent variables in columns 2 and 4 are the change in the natural log of wages and the change in the black labor force share between 1920 and 1930 respectively. Standard errors clustered by state are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

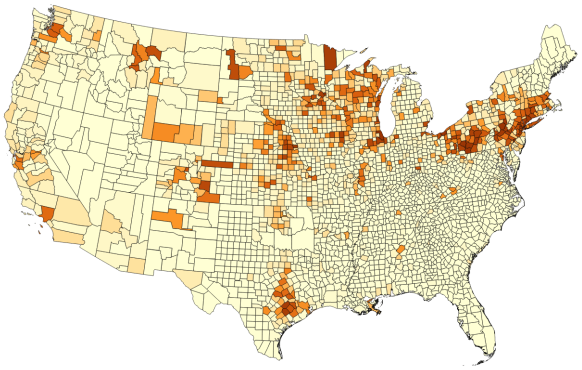
Table A7: Adding Local Demand Shocks

Dependent Variable:	Δln(wage)		ΔBlack L.F. share	
	(1)	(2)	(3)	(4)
Foreign-born share	-1.243**	-1.187*	-0.521***	-0.516***
	(0.614)	(0.607)	(0.145)	(0.143)
Local demand shock 1	0.069		-0.021	
	(0.052)		(0.015)	
Local demand shock 2		0.111*		-0.023
		(0.066)		(0.020)
Observations	2330	2330	2330	2330

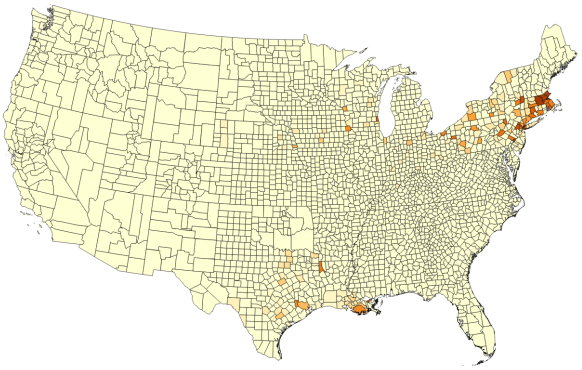
Note: The table reports the estimates from the 2SLS regressions. The regression specification is the same as equation (1) except that I further control for the local demand shock. The control variables include the South dummy, 1/labor force in 1920, and the first-differenced terms of the female share, the urban share, the age composition, and the industrial composition. In columns 1-2 the dependent variable is the change in the natural log of wage between 1920 and 1930. In columns 3-4 the dependent variable is the change in the black labor force share between 1920 and 1930. In columns 1 and 3 the local demand shock is constructed in terms of the number of wage earners as in equation (10). In columns 2 and 4 the local demand shock is constructed in terms of the total employment in equation (11). Standard errors clustered by state are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Figure A1: The Distribution of Immigrants in 1900 by Country

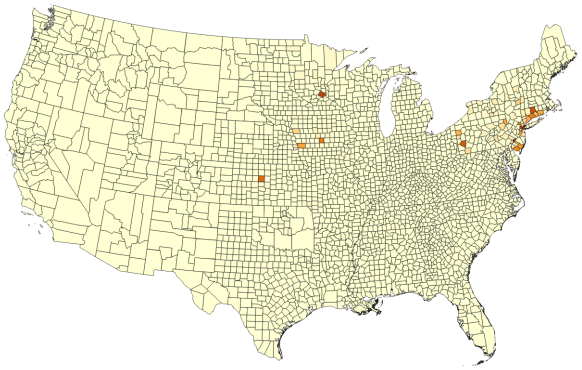
(a) Austria-Hungary



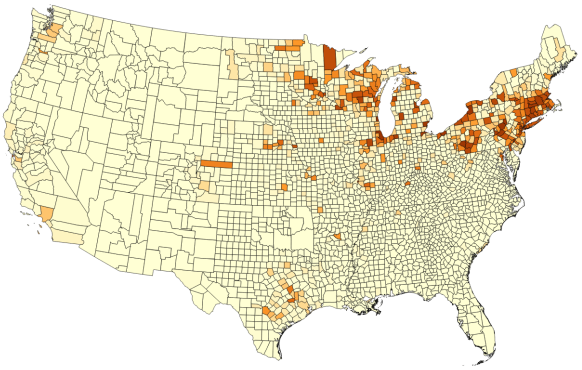
(b) Turkey



(c) Rumania



(d) Poland



(e) Russia

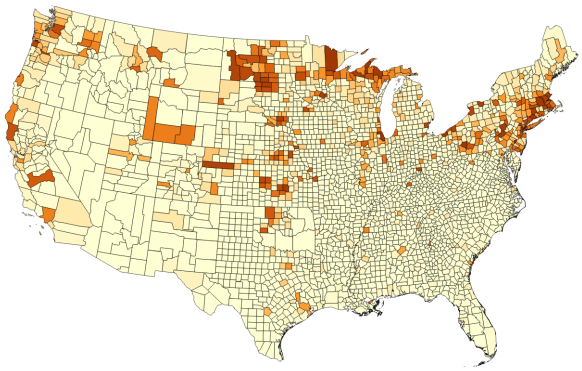
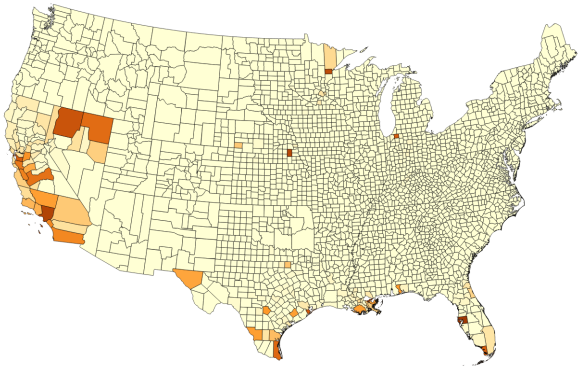
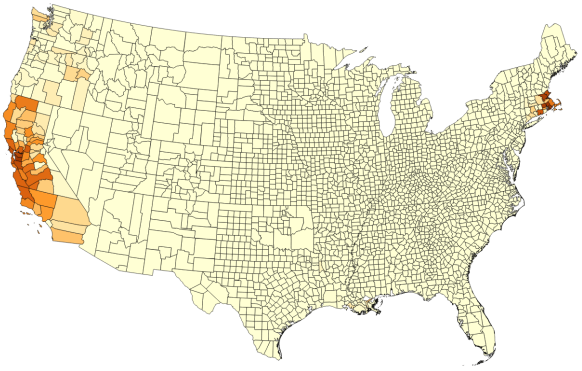


Figure A2: The Distribution of Immigrants in 1900 by Country

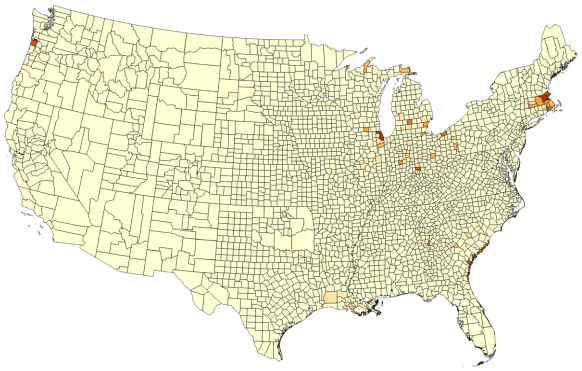
(a) Spain



(b) Portugal



(c) Greece



(d) Italy

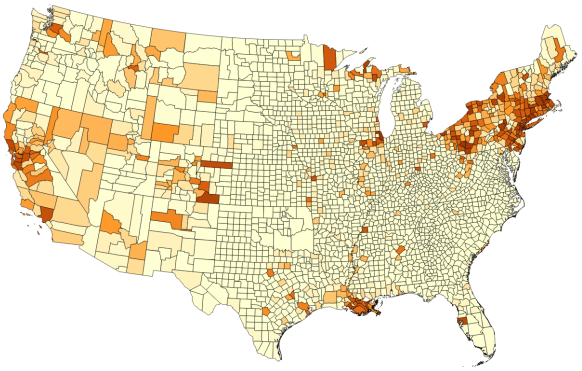
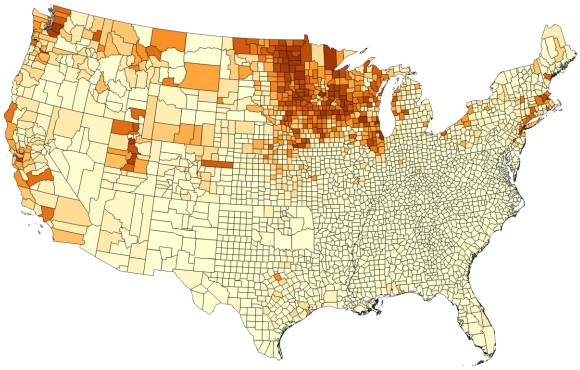
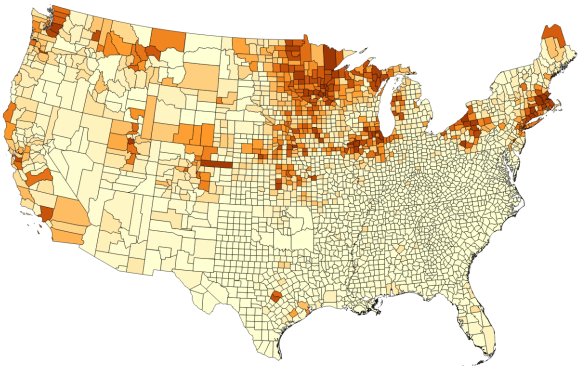


Figure A3: The Distribution of Immigrants in 1900 by Country

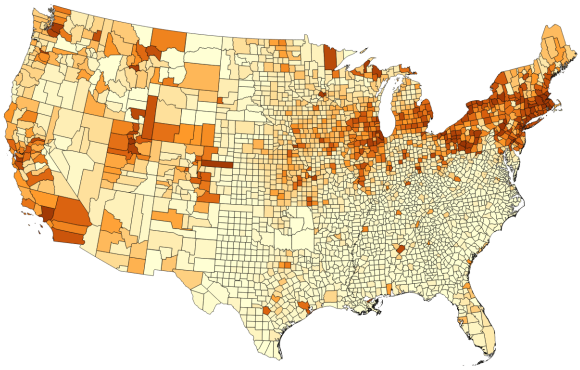
(a) Norway/Denmark



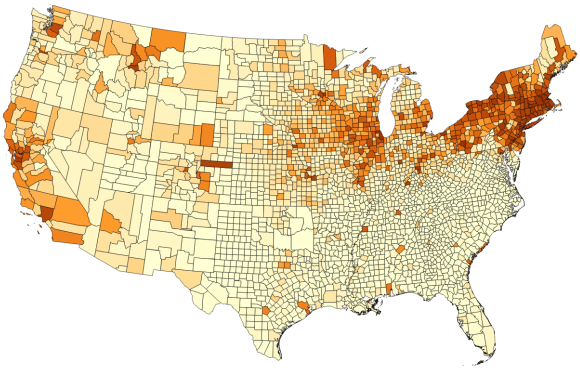
(b) Sweden



(c) Great Britain



(d) Ireland



(e) Germany

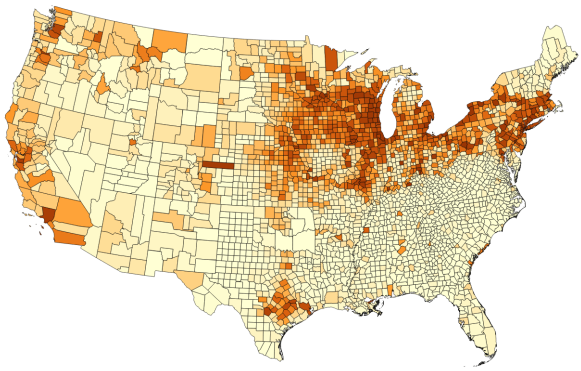
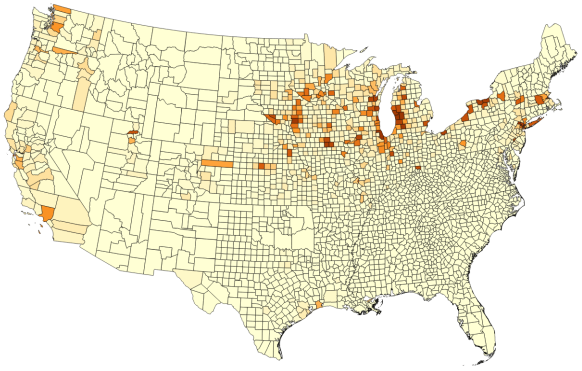
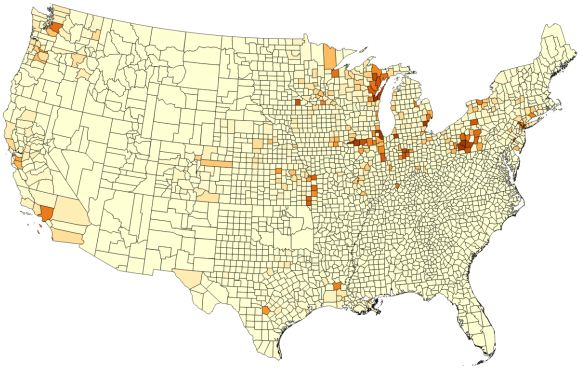


Figure A4: The Distribution of Immigrants in 1900 by Country

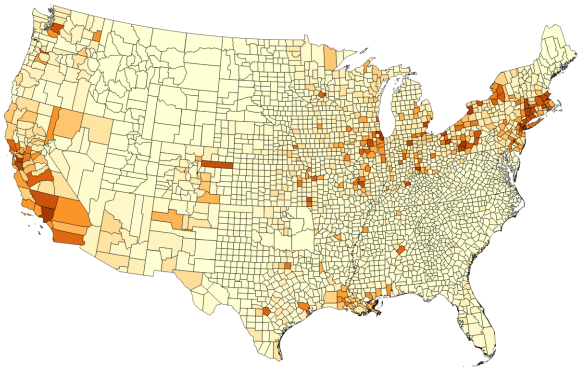
(a) Netherlands



(b) Belgium



(c) France



(d) Swtizerland