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The aggregate and distributional effects of immigration restrictions: The 1920s Quota Acts and the Great Black Migration☆

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ABSTRACT

Using county-level data and linked individual samples, this study explores the labor market impact of the immigration shock triggered by the US immigration quota system and its causal effect on the Great Black Migration. County-level analysis indicates that immigration restrictions did not affect average manufacturing wages and lowered the average occupational standings of US-born whites and immigrants. Analysis of linked individual samples reveals substantial internal migration and distributional effect caused by the immigration shock: migrants moving to counties more impacted by the shock experienced greater economic gains, while non-movers suffered greater losses. Notably, the negative immigration shock led to a marked increase in the migration of Black southerners to northern counties. Black migrants moving to more affected areas achieved higher occupational standings, increased literacy rates, and greater employment in urban manufacturing jobs.

1. Introduction

While extensive literature demonstrates that immigrants gain from migration (McKenzie et al., 2010; Abramitzky et al., 2012) and make various contributions to the host economy (Cortes, 2008; Hunt and Gauthier-Loiselle, 2010; Peri, 2012; Sequeira et al., 2020), economists have not settled the long-standing debate over the labor market effect of immigration. Empirical findings range from significantly negative to neutral or even positive wage effects.[1] This variation arises not only because different methodologies target different structural parameters (Dustmann et al., 2016) but also due to labor market adjustments that may offset the wage impact of immigration-induced labor supply shocks. An immigration shock can lead to labor substitution for native workers,

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[1] For instance, Altonji and Card (1991), Borjas (2003), Llull (2017), and Monras (2020) find that immigration significantly reduces native wages while Card (2001), Dustmann et al. (2012), and Foged and Peri (2016) identify a slightly negative or positive effect of immigration on wages. For comprehensive reviews of the related studies, see Friedberg and Hunt (1995), Lewis and Peri (2015), Blau and Mackie (2016), and Dustmann et al. (2016).

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triggering internal migration or shifts between employment and non-employment statuses. Borjas (2006), Dustmann et al. (2017), Llull (2018). Producers also respond to immigration shocks by adjusting factor intensity (Lewis, 2011; Dustmann and Glitz, 2015). These adjustments lead to substantial distributional effects that create both winners and losers in the labor market. Given the policy significance, further empirical research is needed to examine the distributional impact of immigration shocks in addition to their aggregate effects.

This study examines the aggregate and distributional labor market effects of the negative exogenous immigration shock caused by US immigration restrictions between 1920 and 1930, with a particular emphasis on the causal effect of these restrictions on the Great Black Migration and the individual outcomes of black migrants. In the 1920s, the US established a country-based immigration quota system that disproportionately reduced the inflows of Southern and Eastern European immigrants who were primarily low-skilled labor (Massey, 2016). Consequently, US counties that previously received more immigrants from the se countries experienced a more severe immigration shock. By projecting counterfactual inflows from each sending country and allocating them based on historical settlement patterns, I estimate the number of immigrants "excluded" from each US county by the quota system as an instrument for the county-level change in immigrant population between 1920 and 1930 to identify its labor market impacts. This identification strategy uses the feature of the traditional shift-share instrument in conjunction with a policy shift that exogenously affecting immigrant inflows. The shift-share instrument commonly used in immigration literature are subject to several potential issues.[2] In particular, Jaeger et al. (2018) caution that the shift-share instrument yields biased estimates because the serial correlation of migration causes the conflation of short- and long-run effects. This newly constructed instrument avoids this issue by exploiting the exogenous and sudden change in immigration caused by immigration restrictions.

I first use this instrument in a county-level first-difference model to estimate the aggregate effect of the immigration shock on average manufacturing wages and the occupational income scores of US-born whites, blacks, and immigrants between 1920 and 1930. The results indicate that the decline in immigrant population due to the quota system had no impact on average manufacturing wages but led to the decline in the average occupational standings of US-born whites and immigrants who were relatively high-skilled. On the other hand, the negative immigration shock had no substantial impact on the average occupational standing of US-born blacks who were predominantly low-skilled. The analysis by origin of immigrants further reveals that immigrants with skill levels similar to those of US-born whites experienced a decline in occupational income scores in response to the immigration shock, while low-skilled immigrants resembling those excluded immigrants remained largely unaffected.[3] This null to negative aggregate wage effect of immigration restrictions implies that labor market adjustments effectively absorbed the adverse shock to immigrant labor supply. To illustrate the mechanism, I develop a partial-equilibrium model in which US-born blacks and immigrants are treated as low-skilled perfect substitutes, while US-born whites represent high-skilled labor that substitutes for either immigrants or blacks with a constant elasticity. This model demonstrates that the total wage effect of an immigration shock will be attenuated toward zero through the substitution of native labor for immigrants, as native labor becomes more elastic (e.g. with increased labor mobility). Consistent with the empirical finding, the model also predicts a negative wage effect on high-skilled labor, in addition to the total wage effect, due to its complementarity with low-skilled labor.

To identify the adjustment mechanism by labor substitution, I use the individual samples linked across the 1920 and 1930 censuses to examine the effect of the immigration shock on internal migration. By identifying "non-movers" and "in-migrants" in each county from the linked sample, I calculate the total number of internal migrants to each county between 1920 and 1930 as the outcome for the county-level regression. The results reveal that counties more affected by the immigration shock experienced a larger inflow of internal migrants. The reduced-form estimates indicate that the exclusion of 100 immigrants in a county leads to a total of 60 internal migrants moving into this county. This finding empirically supports the existence of labor substitution through internal labor migration, which likely mitigated the wage response to the immigration shock.[4] Furthermore, I find that foreign-born and US-born black migrants were more responsive to the decline in immigrant population than US-born white migrants.[5]

Given the substantial internal migration, I apply the first-difference model to the linked individual samples to examine the effect of the immigration shock on the occupational income scores of non-movers and in-migrants separately. The results indicates distinct effects on non-movers and in-migrants, especially among US-born whites. A 1-percentage-point decline in immigrant population share decreased the occupational income scores of US-born white non-movers by 0.10%, while those of white in-migrants increased by 0.77%. This finding uncovers a considerable distributional effect of the immigration shock that is obscured by the aggregate effect. While the average occupational standing of US-born whites declined in affected counties, migrants moving into these areas experienced economic gains and benefited from immigration restrictions, whereas non-movers suffered losses. This highlights the

[2] The underlying assumption of the shift-share instrument developed by Card (2001) is that the imputed immigrant inflow to a region is determined by the push factors in the immigrants' country of origin and their ethnic link with their predecessors and is therefore not correlated with region-specific economic conditions. Cortes and Pan (2014) point out that the aggregate immigrant inflows from a sending country can be "pulled" by the booming labor market of a specific region in the host country. For instance, to address this issue, Sequeira et al. (2020) develop an instrument that exploits the fluctuation of immigrant inflows caused by weather shocks in sending countries interacting with the expansion of railroad networks during the Age of Mass Migration.

[3] These findings provide new empirical evidence on the labor market effect of immigration in the historical period. Ferrie (1996b) finds a limited wage effect of immigration during the antebellum period. On the other hand, Goldin (1994) and Hatton and Williamson (1995) find a strongly negative effect of immigration on wages from the late 19th to early 20th century. Tabellini (2020) finds a positive effect of immigration on natives' wages between 1910 and 1930.

[4] This finding also contributes to the literature on the impact of immigration on the internal migration of natives, an area where existing studies have yet to reach consensus. For instance, Card (2001) and Kritz and Gurak (2001) find no substantial evidence of natives' out-migration in response to immigration. On the other hand, Borjas (2006) finds a substantial impact of immigrant inflows on native outflows.

[5] This finding aligns with Cadena and Kovak (2016), who finds that low-skilled Mexican immigrants responded strongly to changes in local labor market demand.

complexities of the wage effect of immigration and the importance of distinguishing the heterogeneous effects of immigration shock on different groups of workers.[6]

To demonstrate the distributional effect of the immigration shock within this unique historical context, I further focus on US-born blacks and identify the causal effect of immigration restrictions on the Great Black Migration, the phenomenal South-to-North migration of US-born blacks in this period. Historical accounts suggest that the decline in immigration in the 1920s created opportunities for black southerners to seek employment in the northern industrial areas (Thomas, 1972). Based on state-level and city-level panel data from 1880 to 1950, Collins (1997) empirically shows that northern areas with fewer immigrants received larger inflows of black population. Using county-level first-difference model with the instrument, I find that the decline in immigrant population due to the quota system significantly increased the inflows of South-to-North black migrants, leading to a larger black population in northern counties: a 1-percentage-point decline in immigration population share in a northern county increases the black population share by 0.08 percentage point. By exploiting the exogenous immigration shock, this study improves on Collins (1997) and establishes a more credible causal relationship between the decline in immigration due to the quota system and the Great Black Migration.

I further investigate the impact of the immigration shock on the socioeconomic outcomes of black migrants and non-movers in northern counties. Black migrants in affected counties experienced substantial gains in occupational standing. A 1-percentage-point decrease in immigrant population share in a county increases the occupational income score of black migrants moving to this county by 1.09%. Black migrants in northern counties more affected by the immigration shock were more likely to become literate and work in manufacturing. Black non-movers in affected counties were also more likely to have high-skilled occupations. These findings bridge the immigration restrictions and the individual socioeconomic outcomes of US-born black migrants and existing black population in the North, contributing to the literature on the causes and consequences of the Great Black Migration.[7]

Aside from native labor substitution, the theoretical model suggests that adjustments in production also attenuate the labor market effect of immigration.[8] Prior studies also show that immigration does affect the relative input factor intensities of producers (Lewis, 2013; Dustmann and Glitz, 2015; Lafortune et al., 2019), technology adoption (Clemens et al., 2018), and output mix (Lafortune et al., 2015; Clemens et al., 2018).[9] Empirically, I examine the effect of immigration restrictions on input factor intensity, output decision, and the entry and exit of manufacturing firms. I find that this negative immigration shock led firms to reduce both capital and labor inputs simultaneously. A 1-percentage-point decline in immigrant population share decreases establishment size and value added per establishment by 1.6% and 2.0%. Meanwhile, the capital-to-labor ratio and labor productivity of firms were not affected. In addition, the decline in immigration led to the entry of manufacturing establishments. These results suggest that manufacturing firms were able to adjust inputs flexibly in response to the immigration shock.

The findings of this study contribute to the strand of research on how immigration restrictions, as active policy interventions, affect the domestic labor market. Lee et al. (2017) and Clemens et al. (2018) show that the expatriation of Mexicans in the 1930s and the *Bracero* exclusion in the 1960s had virtually no effects on native wages and employment. Exploiting the immigration shock due to the WWI and the quota system, Tabellini (2020) finds that immigration improved natives' economic outcomes but led to stronger political oppositions due to increasing cultural distance. One closely related study is the parallel work by Abramitzky et al. (2023) that similarly examine the effect of the immigration shock due to immigration quotas on native wages and labor market adjustments.[10] Regarding the aggregate labor market effect, the findings of this study are largely consistent with those of Abramitzky et al. (2023), indicating that the average wages of US-born whites declined in response to the negative immigration shock. Different from Abramitzky et al. (2023) that emphasize the labor substitution between restricted and unrestricted immigrants, this study highlights the internal migration of US-born blacks, particularly those from southern states, who filled the roles of excluded immigrants and identifies the causal impact of the immigration quota system and the Great Black Migration. Using linked individual samples, I also conduct individual-level analysis to further examine the effect of the immigration shock on various outcomes of black migrants and non-movers in northern states to uncover the distributional effect of the immigration restrictions.

The remainder of this paper is structured as follows: Section 2 provides the historical context of the U.S. immigration quota system and the Great Black Migration in the 1920s. Section 3 discusses the data and summary statistics. Section 4 outlines the empirical framework and presents the results. Section 5 offers robustness checks, and Section 6 concludes the paper.

[6] Likewise, Dustmann et al. (2017) investigate the impact of Czech workers entering the labor market on the outcomes of German natives and identified significant labor market adjustments that lead to diverse effects across various segments of the workforce. They observed that unemployed workers absorbed much of the employment impact, thus mitigating the labor supply shock experienced by employed workers.

[7] Higgs (1976), Tolnay and Beck (1992), Lange et al. (2009), and Hornbeck and Naidu (2014) investigate the push factors behind the black migration, including growing racial violence, disruption to agricultural production due to boll weevil, and the Great Mississippi Flood. Regarding the consequences of the Great Black Migration, Hornbeck and Naidu (2014) find that agricultural production in the South became more capital-intensive following the out-migration of blacks. Boustan (2010) shows that it caused the "white flight" and a higher degree of residential segregation in the North. Collins and Wanamaker (2014, 2015) examine the economic gains and the selection of black migrants in the first decades of the Great Migration. Black et al. (2015) find that migration increased the mortality of the blacks born in the South. Derenoncourt (2022) shows that the racial composition shock caused by the Great Migration caused the lower upward mobility of black families today.

[8] Provided that the supply of capital is elastic, firms can adjust capital in response to changes in aggregate labor supply, which yields a relatively flat labor demand curve and weakens the wage response to the immigration shock. Refer to the model for a formal illustration.

[9] See Lewis (2013) for a review of studies on the effects of immigration on firm production.

[10] During my independent research progress (Xie, 2017), I became aware of the concurrent work by Ager and Hansen (2017) studying the effect of the immigration quota system on natives' labor market outcomes, which later merged with Abramitzky et al. (2023). In addition to these studies, Greenwood and Ward (2015) and Massey (2016) examine the impact of the quota system on immigrants' return migration and selection. Doran and Yoon (2018) also examine the effect of the quota system on US innovation.

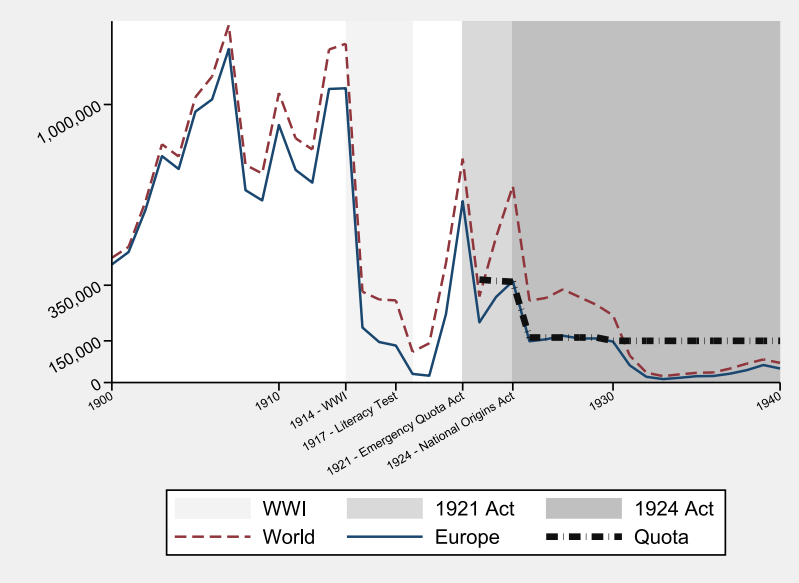


Fig. 1. Annual immigration to the US and annual quota.
Note: This figure plots the annual immigration to the US from all countries (in red dashed line) and from Europe (in blue solid line) between 1900 and 1940 and total annual quota between 1921 and 1940 (thick dash-dotted line). The light gray shaded area represents the World War I years. The medium-gray and dark-gray shaded areas indicate the years under the Emergency Quota Act of 1921 and under the Immigration Act of 1924, respectively. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

2. Historical background

2.1. Immigration quota system

At the beginning of the 20th century, the US witnessed a rising tide of immigrants from Europe, with annual arrivals exceeding 1 million during peak years (Fig. 1). Notably, 70%–80% of these immigrants originated from Southern and Eastern European countries. Anti-immigration sentiments grew rapidly, fueled by assertions of the racial inferiority of these new immigrants and concerns about their adverse impact on the country (Hourwich, 1969). In the address to Congress in 1903, President Theodore Roosevelt stated the principle of US immigration policy, paving the way for the subsequent immigration quota system: "We cannot 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 which undesirable immigrants shall be kept out entirely, while desirable immigrants are properly distributed throughout the country". [11] The Dillingham Commission was convened in 1907 to investigate the social and economic consequences of new immigrants from Southern and Eastern Europe. After four years of investigation, the commission published a 42-volume report concluding that new immigrants were unable to assimilate and detrimental to US society (Dillingham, 1911). The commission recommended legislation to limit immigration through financial requirements, literacy tests, and quotas. In 1917, Congress passed the Literacy Act, mandating a literacy test for adult immigrants and excluded immigrants from the "Asiatic Barred Zone". [12] The literacy test was intended to limit the inflows of immigrants mainly from Southern and Eastern Europe who were less educated due to the lack of mass schooling in these countries (Easterlin, 1981).

Advocacy for a more restrictive immigration policy culminated the enactment of the Emergency Quota Act of 1921. This legislation established annual limits on immigration from European, African, Oceanian, and certain Asian countries, capping it at "...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" (of Labor, 1922).[13] The quota allotted to a country, if not filled, could not be carried over to the following year nor filled by immigrants from other countries. Following the passage of the act, the quota system was promptly implemented, with a total quota of 357,803 for the 1921–1922 fiscal year. Demand from potential migrants swiftly depleted quotas for most

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

[12] In addition, the act mandated medical examinations and barred entry for individuals deemed undesirable, including those with mental or physical defects, criminals, alcoholics, prostitutes, polygamists, anarchists, and others.

[13] Immigration from China and countries in the "Asiatic Barred Zone" was banned by the Chinese Exclusion Act of 1882 and the Literacy Act of 1917. Japan consented to not sending any immigrants to the US under the Gentlemen's Agreement of 1907. Asian countries and regions with quotas in the Emergency Quota Act of 1921 include Palestine, Syria, Cyprus, the Hejaz, Iraq, Persia and Rhodes. Immigration from Canada, Mexico, and South American countries was not subject to quotas.

countries, particularly those in Southern and Eastern Europe.[14] In 1921, European immigrant inflows to the US plummeted by more than half compared with the previous year.[15]

The Emergency Quota Act of 1921 expired the following year but was extended for an additional two years with minor revisions to the quotas. The Immigration Act of 1924 further tightened restrictions by setting the quotas at 2% of the foreign-born population from each country in the 1890 population census.[16] Due to the lower proportion (2% instead of 3%) and the adoption of an earlier population base (1890 census instead of 1910 census), the quotas were reduced to 164,667 in total and more favored Western and Northern European immigrants.[17] The Emergency Quota Act of 1921 and the Immigration Act of 1924 marked the onset of the country-based immigration quota system. This quota system primarily curtailed the inflows of low-skilled immigrants, as demonstrated by Massey (2016), who finds that after its implementation, the immigrant population became more positively selected.

Discriminatory Nature of the Quota System – As intended, the quota system imposed much stricter restrictions on immigration from Southern and Eastern European countries than on those from Western and Northern European countries. At the time of its implementation, Southern and Eastern European immigrants were migrating to the US in large numbers, while the heyday of immigration from Western and Northern Europe was over. Despite this significant influx, Southern and Eastern European countries were allocated low quotas because their immigrants had not yet made up a substantial portion of the US population.

To demonstrate the intensity of immigration restrictions on each country, Table B.1 presents a comparison of the annual quotas and average annual immigrant inflows between 1900 and 1914 for each European country. Column 4 shows that the quotas assigned to Southern and Eastern European countries by the Emergency Quota Act of 1921 represented between 15% and 34% of their average annual inflows before quota, with the exception of Russia (76%) and Romania (159%). In contrast, the quotas assigned to Western and Northern European countries represented between 69% and 236% of their annual inflows before quota, Belgium being the exception (33%). The Immigration Act of 1924 further reinforced this discrimination against Southern and Eastern European immigrants. The quota-to-inflow ratio fell below 7% for most Southern and Eastern European countries while it remained above 30% for Western and Northern European countries (column 5).[18]

Regional variation of the immigration shock – The immigration quota system triggered an exogenous immigration shock that varied across US counties due to the differing geographical distributions of immigrants from various countries (Abramitzky and Boustan, 2017).[19] Eastern European immigrants, especially Turkish and Romanians, tended to concentrate in the Northeast and a significant share of Austro-Hungarians, Polish, and Russian immigrants also lived in the Midwest in 1900. Southern Europeans preferred to live in the Northeast and the West. On the other hand, Western and Northern European immigrants were relatively dispersed in the Northeast, the Midwest, and the West, and a large proportion of Scandinavians were concentrated in the northern border states, including North Dakota, Minnesota, and Wisconsin. Because of the serial correlation of the settlement pattern of immigrants from the same country, US counties with more Southern and Eastern European immigrants experienced a larger reduction in immigrant inflows compared with those with more Western and Northern European immigrants (Gallaway et al., 1974; Bartel, 1989).[20] In Section 4, I estimate the number of immigrants excluded from each county by the quota system to quantify this exogenous immigration shock.

2.2. The Great Black Migration

The 1920s also witnessed the first wave of the Great Black Migration, during which over 1 million black southerners migrating to northern states (Lewis, 1931; Fligstein, 1981). Fig. B.1 illustrates the changes in the black population share at both the state and county levels from 1920 to 1930. In the 1920s, the share of black population declined in the southern states and increased considerably in the northern and western states. In addition, there was notable internal movement within the South, primarily from rural to urban counties.

Despite the substantial income disparity between the South and North and the oppressive conditions imposed by Jim Crow laws (Roback, 1984; Wright, 1987), scholars have long been puzzled by the fact that black southerners only began to migrate out of southern states massively in the 1910s.[21] Thomas (1972) hypothesizes that the out-migration of black southerners was hindered by

[14] With the maximum monthly admission set at 20% of the total annual quota, many countries had their quotas filled within the first five months of enforcement.

[15] The total quota for the 1921–1922 fiscal year was not completely exhausted mainly due to the large number of unfilled slots assigned to Germany (19,053 filled, out of 68,059 slots) and the United Kingdom (42,670 filled, out of 77,342 slots).

[16] The second provision of the act stated that from July 1, 1927, the quotas (2% of the foreign-born population base in the 1890 census) will be replaced by a total annual quota of 150,000 in proportion to the inhabitants of the same national origin in the 1920 census. This provision was postponed and came into effect in 1929.

[17] Online Appendix Table B1 lists the quotas assigned to all countries under the Emergency Quota Act of 1921 (and its extension) and the Immigration Act of 1924.

[18] As the most extreme case, the annual quota assigned to Greece was merely 100 in 1924 in contrast to its pre-quota average annual inflow of 8507.

[19] Figures B1–B4 in the Online Appendix show the distributions of immigrants from European countries in US counties in 1900 as heat maps, with darker color indicating a higher proportion of immigrants living in this county in 1900. Online Appendix Table B2 presents the three states and counties with the highest shares of immigrants in the total immigrant population from the same country in 1900.

[20] One important reason for the tendency of new immigrants to settle where existing immigrants of the same origin live is that ethnic social networks reduce the cost of migration and facilitate labor market integration (Dunlevy and Gemery, 1977; Lafortune and Tessada, 2010).

[21] Previous studies have explored the institutional factors in the South that delayed the black migration, such as recruitment restrictions and paternalism (Alston and Ferrie, 2007; Naidu, 2010).

intense competition for job opportunities with European immigrants in the North.[22] This "immigrant-as-deterrent" theory aligned with the notable feature of the Great Black Migration, which took place during a downturn in the US immigration following World War I and subsequent immigration restrictions.[23] Following the implementation of the quota system, which limited the influx of low-skilled immigrants, manufacturing firms in northern states actively dispatched labor agents to the South to recruit black southerners as replacement for the immigrant workforce. Recruitment information was also passed to the South via newspapers and messages from relatives and friends in the North.[24] These anecdotal accounts imply a causal relationship between immigration restrictions and the Great Black Migration.[25] Applying fixed-effects model to state- and city-level panel data, Collins (1997) shows that northern areas with fewer immigrants experienced larger inflows of black population. In this study, I use the IV approach to strictly identify the causal impact of the immigration quota system on the Great Black Migration in the 1920s.

3. Data

3.1. Data sources

This study combines data from various sources for empirical analysis. Due to the lack of comprehensive individual wage data for this period, I use two proxies for wages. First, I collect county-level average manufacturing wages from the tabulations of the 1919 and 1929 US Censuses of Manufactures, which have been digitized by Haines (2010). These wages are calculated as the total wage bill paid to wage workers divided by the number of wage workers in the manufacturing sector. A limitation of using average manufacturing wages is that it does not allow for the distinction between the wages of US-born workers and those of immigrants. The second indicator is the occupational income score available in the IPUMS full-count census micro-samples (Ruggles et al., 2016). For county-level analysis, I aggregate the 1920 and 1930 full-count census samples of workers aged 16–65 by country of birth and race to the county level to compute the average occupational income scores of US-born whites, immigrants, and US-born blacks in each county in 1920 and 1930. Since the occupational income score is imputed as the median income of all persons within each occupation in the 1950 census, it lacks the granularity to capture wage dynamics within occupations. I provide a detailed discussion of its potential influence on the estimation in Section 4.2.

I aggregate the full-count census samples by country of birth and race to the county level to obtain the population of US-born whites, immigrants, and US-born blacks in each county in both census years.[26] To control for county-level demographic and economic characteristics, I construct additional county-level variables from the census samples, including female population share, literacy rate, and age composition (16–24; 25–34; 35–44; 45–54; 55–65), manufacturing employment share, and 2-digit industrial employment composition in the manufacturing sector of each county.

For the analysis of internal migration and the distributional wage effect, I construct a panel dataset of individuals linked across the 1920 and 1930 census samples based on individual name, year of birth, and place of birth. The linking procedure is to go through all male individuals in the 1920 census to search for the unique match in the 1930 census based on first and last name, year of birth within a 5-year bandwidth (exact year+/−2 years), and state or country of birth (Abramitzky et al., 2014, 2021).[27] I keep linked individuals aged over 16 in 1920 and under 65 in 1930. This linked individual sample allows me to identify "non-movers" who lived in the same county in 1920 and 1930, and "migrants" who lived in different counties in 1920 and 1930. For the county-level analysis of internal migration, I aggregate the linked individual sample to the county level to obtain the numbers of US-born white, foreign-born, and US-born black migrants who moved into each county between 1920 and 1930.

To examine the adjustments in production, I obtain county-level statistics of the manufacturing sector from the 1919 and 1929 US Censuses of Manufactures, including the number of manufacturing establishments, number of wage workers, total horsepower, and value added by manufacture of each county.[28]

To construct the instrumental variable, I collect the quotas allotted to each European country and the annual immigrant inflows from each European country to the US from the *Annual Reports of the Commissioner-General of Immigration to the Secretary of Labor*

[22] This argument can be illustrated by the Harris–Todaro model (Harris and Todaro, 1970). The decision of black southerners to migrate to the North was jointly determined by the reservation wage in the agricultural sector in the South, the cost of migration, and the expected wage in the urban sector in the North. If the expected wage is lower than the reservation wage plus the migration cost due to the low probability of finding a job in the North, migration will not take place.

[23] The burgeoning demand for military products during the wartime has also boosted the labor demand of northern manufacturing industries (Grossman, 1989).

[24] For instance, an advertisement in the *Chicago Defender*, a Chicago-based newspaper founded in 1905 primarily for African Americans, reads: "Help Wanted – Male MEN!! If you are seeking employment, come to Milwaukee, Wis. Wages $2.50 to $6.00 per day. Board and lodging reasonable". (*Chicago Defender*, December 1, 1917).

[25] A simple correlation analysis presented in Online Appendix Table B3 also shows that the immigrant population is negatively correlated with the black population at the county level in terms of both level and change between 1920 and 1930.

[26] Using the full-count sample for aggregation effectively avoids the attenuation bias that can occur due to classical sampling error when the sample size in each cell is not large enough (Aydemir and Borjas, 2011).

[27] This procedure is a fully automated approach developed from the matching strategy initially used by Ferrie (1996a). I am grateful to the research team of the Census Linking Project (https://censuslinkingproject.org) for sharing the codes and crosswalks for matching (Abramitzky et al., 2021).

[28] The statistics of horsepower in the census include the total rated capacity of primary power equipment (engines, water wheels, and water turbines) of manufacturing establishments plus rented electric power. I use horsepower as a proxy for capital stock, as capital data are not available in the 1929 census and the correlation of capital and total horsepower in the cross section from the 1919 census is greater than 0.9. Value added by manufacture is calculated by deducting the cost of the materials used from the value of the products.

between 1892 and 1929 and *International Migrations: Volume I Statistics* (Ferenczi and Willcox, 1929). The boundaries of countries are adjusted to ensure the consistency of the immigration statistics over time.[29]

3.2. Summary statistics

Table 1 presents the summary statistics of the balanced county-level panel data of 1920 and 1930.[30] The full sample includes 2537 counties in 48 states (excluding Hawaii and Alaska), and the sample of the North includes 1483 counties in 34 non-southern states.[31] As a result of immigration restrictions, the average immigrant population share decreased from 19.9% to 16.9% across all counties and from 25.3% to 21.6% in northern counties from 1920 to 1930. In contrast, the black population share in northern counties rose from 3.2% to 4.0%. Meanwhile, the average manufacturing wage increased by 15% across the full sample and by 18% in northern counties. In both census years, US-born whites and immigrants had significantly higher occupational income scores than US-born blacks. From 1920 to 1930, the number of manufacturing establishments decreased by more than 25%, while the average size and production output increased significantly. Horsepower and value added per wage worker also increased substantially. Northern counties had higher proportions of capital-intensive industries than the South, such as iron and steel, machinery, and transportation equipment.

4. Empirical analysis

4.1. Empirical framework

I apply the first-difference model to the spatial approach to empirically examine the aggregate wage effect of immigration in this decade. Consider a simplified two-region and two-period setting for illustration, the natural logarithm of the average wage in region i at time t is determined by the following equation:

$$\ln w_{it} = \theta I_{it} + D_t + \eta_i + \varepsilon_{it} \tag{1}$$

where $I_{it} = \frac{im_{it}}{na_{it}}$ is the population share of immigrants, measured as the ratio of immigrant population to the native population. D_t and η_i are the time and region fixed effects. Differencing Eq. (1) over two periods eliminates region fixed effects η_i, which is a potential source of omitted variable bias in cross-sectional estimation:

$$\Delta \ln w_i = \theta \Delta I_i + \Delta D + \Delta \varepsilon_i \tag{2}$$

Differencing Eq. (2) over two regions (denoted by a and b) yields the following equation:

$$\Delta \ln w_a - \Delta \ln w_b = \theta(\Delta I_a - \Delta I_b) + (\Delta \varepsilon_a - \Delta \varepsilon_b) \tag{3}$$

The coefficient $\theta = \frac{\Delta \ln w_a - \Delta \ln w_b}{\Delta I_a - \Delta I_b}$ identifies the aggregate effect of immigration on wages if $\Delta \varepsilon_a = \Delta \varepsilon_b$.[32]

Consider Eq. (2) as the baseline regression model, the zero conditional mean assumption to obtain an unbiased OLS estimate of θ is $E(\Delta \varepsilon_i | \Delta I_i) = 0$. However, the omitted variable bias still occurs when unobserved changes in regional labor market conditions affect wage trends and attract immigrants simultaneously. To control for characteristics that both affect wages and the immigrant share, the full-fledged specification of the level equation is as follows:

$$\ln w_{it} = \theta I_{it} + X_{it}\beta + M_i \xi_t + \gamma_{st} + D_t + \eta_i + \varepsilon_{it} \tag{4}$$

where w_{it} is the county-level indicator of labor market outcomes, including the average manufacturing wage, and the average occupational income scores of individual groups of interest. X_{it} is a vector of county characteristics at time t, including age composition, literacy rate, and female share. M_i is a vector of county characteristics in 1920, including the manufacturing employment share and the industrial composition of the manufacturing sector in 1920, to accounts for the effect of county characteristics on the trend of the outcomes. In addition, I include γ_{st}, where s denotes state, to account for state-specific time fixed effects. The corresponding first-difference regression specification over the two periods of 1920 and 1930 is as follows:

$$\Delta \ln w_i = \theta \Delta I_i + \Delta X_i \beta + M_i \Delta \xi + \Delta \gamma_s + c + \Delta \varepsilon_i \tag{5}$$

[29] The list of European countries after adjustment includes Austria–Hungary, Belgium, Denmark–Norway, France, Germany, Great Britain, Greece, Ireland, Italy, Poland, Romania, Portugal, Russia, Switzerland, Sweden, Spain, and Turkey. Refer to the data appendix for details of the boundary adjustments in the Online Appendix.

[30] The county boundaries are adjusted for consistency over time. All county boundary adjustments 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 their statistics. If a county is created from several segments of more than one county, I merge all counties concerned and aggregate their statistics.

[31] For convenience, I use "North/northern counties" to refer to all counties in non-southern states that includes 9 states in the Northeast, 12 states in the Midwest, 11 states in the West, Delaware, and Maryland.

[32] This equation corresponds to Eq. (A.12) in the theoretical model.

Table 1
Summary statistics of county characteristics in 1920 and 1930.

Sample	All counties		Northern counties	
	1920 (1)	1930 (2)	1920 (3)	1930 (4)
Population Composition				
Immigrant population share	0.199	0.169	0.253	0.216
US-born black population share	0.106	0.106	0.032	0.040
Literate population share	0.933	0.955	0.962	0.976
Labor market outcomes				
Average manufacturing wage	1158	1334	1193	1409
	(217)	(283)	(197)	(210)
Occupational income score				
US-born white	19.6	20.0	20.3	20.6
	(3.0)	(3.1)	(2.8)	(2.9)
Immigrant	21.5	22.4	20.1	20.7
	(5.3)	(5.6)	(3.1)	(3.3)
US-born black	15.5	15.3	16.6	16.7
	(3.4)	(3.7)	(3.7)	(3.9)
Manufacturing sector				
Manufacturing employment share	0.195	0.181	0.220	0.198
Industrial employment composition				
Food and kindred products	0.056	0.073	0.058	0.074
Textiles and their products	0.143	0.157	0.138	0.140
Forest products	0.082	0.084	0.058	0.060
Paper and allied products	0.015	0.019	0.017	0.021
Printing and publishing	0.038	0.053	0.041	0.058
Chemical and allied products	0.011	0.017	0.008	0.015
Petroleum and coal products	0.010	0.013	0.008	0.011
Rubber products	0.018	0.013	0.021	0.016
Leather products	0.034	0.032	0.039	0.038
Stone, clay, and glass products	0.022	0.028	0.022	0.028
Iron and steel products	0.100	0.109	0.111	0.122
Nonferrous metals	0.022	0.018	0.024	0.021
Machinery	0.068	0.073	0.077	0.085
Transportation equipment	0.083	0.074	0.090	0.086
Railroads and railways	0.205	0.172	0.193	0.161
Miscellaneous industries	0.093	0.063	0.096	0.064
Number of establishments	121.8	88.5	175.1	128.6
	(650.0)	(578.5)	(852.1)	(759.4)
Wage workers per establishment	31.7	42.0	33.3	42.8
	(23.6)	(29.6)	(23.9)	(28.9)
Horsepower per establishment	102.1	203.4	104.2	205.3
	(126.8)	(271.0)	(131.3)	(276.4)
Value added per establishment	87.2	151.5	94.4	162.2
	(73.1)	(119.3)	(73.4)	(110.6)
Horsepower per wage worker	3.2	4.8	3.1	4.8
	(2.4)	(3.4)	(2.4)	(3.4)
Value added per wage worker	2.754	3.608	2.833	3.789
	(0.710)	(1.213)	(0.637)	(0.979)

Note: Columns 1 and 2 report the means of the variables in the full sample in 1920 and 1930. Columns 3 and 4 report the means of the variables in the sample of northern counties in 1920 and 1930. Standard deviations are reported in parentheses.

where $\Delta\gamma_s$ becomes the state-specific time trends. To further address the omitted variable bias, I exploit the immigration shock caused by immigration quotas to construct an instrument for ΔI_i, which is arguably exogenous to the changes in local labor market conditions after controlling for full covariates.

To construct the instrument, I quantify the negative immigration shock due to immigration quotas by estimating the number of "excluded" immigrants from each sending country and distributing them to each US county based on the shift-share approach. There are two main reasons for not using the quotas directly to measure the shock. First, the quotas *per se* do not accurately reflect the intensity of the policy shock unless they are compared with the potential inflows of immigrants.[33] This can be illustrated by comparing Italy and France, both allotted an annual quota of around 3900. The quota severely dampened immigration from Italy, accounting for only 1.9% of its pre-quota inflow, while imposing relatively moderate restrictions (50%) on French immigrants

[33] In addition, the sudden cessation of large subsequent inflows may have caused the return migration of existing immigrants expecting family reunification, also affecting the change in the immigrant stock. This effect can only be captured by the number of excluded immigrants.

(Table B.1). In particular, the quota effectively imposed no restrictions when it was not binding for certain countries.[34] Second, when we directly allocate quotas to each county as the instrument, those with historically low immigrant stocks receive disproportionately small quotas. If smaller quotas are presumed to indicate stronger adverse immigration shocks, it implies that these counties experienced the most severe adverse immigration shocks under the quota system, which is logically incorrect. Therefore, I estimate the counterfactual immigrant inflows assuming no quotas were imposed in order to determine the number of immigrants who were "excluded" by the quotas. The number of excluded immigrants characterizes the extent to which the potential immigrant inflows were restricted by the quotas and measures the intensity of the negative immigration shock. More excluded immigrants distributed to a county indicate a more adverse immigration shock to the county.

Projection of counterfactual inflows – The theoretical basis for the projection of counterfactual immigrant inflows is the emigration life cycle theory (Zelinsky, 1971; Akerman, 1976; Hatton and Williamson, 1998), This theory posits that a country's emigration experience typically follows a bell-shaped pattern, with emigration rates rising sharply initially and then declining as the country industrializes. This pattern was first observed among Swedish emigrants (Akerman, 1976) and later generalized to most European countries during the Age of Mass Migration (Massey, 1988; Hatton and Williamson, 1998). Due to delayed industrialization, Southern and Eastern European countries typically commenced their emigration life cycle later than Western and Northern European countries. The immigration quota system was enforced when immigration from Western and Northern Europe was declining, while immigration from Southern and Eastern Europe was still increasing sharply or reaching its peak (Fig. B.2).

For the purpose of projection, I assume that immigration from European countries to the US would have followed the life cycle pattern without the intervention of the quota system, given that the US was the primary destination for European emigrants during the Age of Mass Migration.[35] Specifically, I fit the immigrant inflows in the pre-quota period (1879–1914 and 1921) to a quadratic polynomial of time to estimate the curve of the emigration life cycle, thereby projecting the counterfactual immigrant inflows in the post-quota period (1922–1929) for each country. The abnormally low immigrant inflows between 1915 and 1920 are excluded from projection because they significantly distort the contour of the life cycle.[36] I incorporate immigrant inflows from 1921, as they appear to have reverted to a normal level, serving as an anchor for the "natural" post-World War I immigration level without quotas.

Figs. 2 plots the projected and actual inflows of immigrants from European countries from 1879 to 1929, along with the annual quotas assigned to each country. Among Southern and Eastern European countries, the projected immigrant inflows from Austria–Hungary, Poland, Russia, Italy, and Greece exhibit a stylized life cycle pattern, while those from Romania, Turkey, Portugal, and Spain show a monotonic upward trend, as the immigrant inflows from these countries did not decrease during the pre-quota period.[37] Immigration from most Western and Northern European countries peaked before the late 19th century, resulting in fitted curves that often show slight upward or downward trends. The comparison of projected inflows with the quotas clearly indicates that Southern and Eastern European immigrants were disproportionately "excluded" by the quotas. It is noteworthy that this pattern is not peculiar to this projection method I adopt here, given the stark contrast of the pre-quota inflows of Southern and Eastern Europeans and their assigned quotas. In Section 5.1, I apply several alternative projection methods (cubic curve-fitting, fractional polynomial curve-fitting, moving average, and a fixed level as the inflow in 1921) to construct the counterfactual inflows and the instrument, and the estimations are highly robust.

Excluded immigrants as the IV – The total number of excluded immigrants from country c (denoted as ΔF_c) is calculated the non-negative difference between the annual counterfactual inflow $\hat{F}_{ct}$ and the annual quota Q_{ct} summed over the period of 1922–1929: $\Delta F_c = \sum_{t=1922}^{1929} max\,(\hat{F}_{ct} - Q_{ct}, 0)$. To obtain the number of excluded immigrants in each US county, I then follow the approach of the traditional shift-share instrument to allocate excluded immigrants to each county based on the origin-specific geographical distribution of immigrants in the 1900 census. Specifically, let S_{ci} be the number of immigrants from sending country c who lived in county i in 1900, the share of immigrants from country c in county i in the total immigrant population from country s is: $P_{ci} = \frac{S_{ci}}{\sum_{i \in I} S_{ci}}$. Based on the $S \times I$ distribution matrix of immigrants from all sending countries S in all US counties I, the total number of excluded immigrants assigned to each US county i, denoted by E_i, is calculated as: $E_i = \sum_{c \in C} P_{ci} \times \Delta F_c$. To account for the difference in county population size, I construct the instrumental variable as the number of excluded immigrants E_i divided by the labor force of county i in 1920, which I refer to as the normalized number of excluded immigrants.

Instrument relevance – To demonstrate the instrument relevance, Figs. 3a and 3b plot the normalized number of excluded immigrants and the change in the share of immigrant in each county between 1920 and 1930 as heat maps. The maps reveal that counties heavily impacted by the quotas experienced a more significant decline in immigrant population share in this decade. Counties in the Northeast, Midwest, and West were particularly affected by the quotas. Conversely, most counties in the South had few excluded immigrants due to their low historical stock of immigrants. Fig. 3c displays a scatterplot of all counties, where the

[34] Therefore, the optimal time frame for analysis is the 1920–1930 period, as the quotas assigned to most countries were not binding in the 1930s due to the Great Depression, weakening the statistical power of the instrument.

[35] The general approach in the literature to estimate the emigration life cycle is to consider the total emigration of a country as a quadratic function of time (Hatton and Williamson, 1998). However, lack of consistent data on population and emigration statistics, especially in Eastern Europe, does not allow me to strictly follow this approach. Because the total emigration of an European country and its emigration to the US were highly synchronized during this period, it is reasonable to assume that its emigration to the US had a trajectory similar to its full emigration life cycle.

[36] The World War I threw the transatlantic shipping business into disarray and severely disrupted immigration from Europe.

[37] Although this can potentially lead to questionably high projected values, a cross-country comparison of emigration rates (emigrants per 1000 persons) indicates that the highest projected immigration inflows from these countries are still within the reasonable range and below the peak values of the immigrants inflows from Ireland and Sweden that have experienced the full life cycle. The highest emigration rate based on my projections is around 6 emigrants per 1000 persons and the highest rates for Ireland and Sweden are above 10 emigrants per 1000 persons.

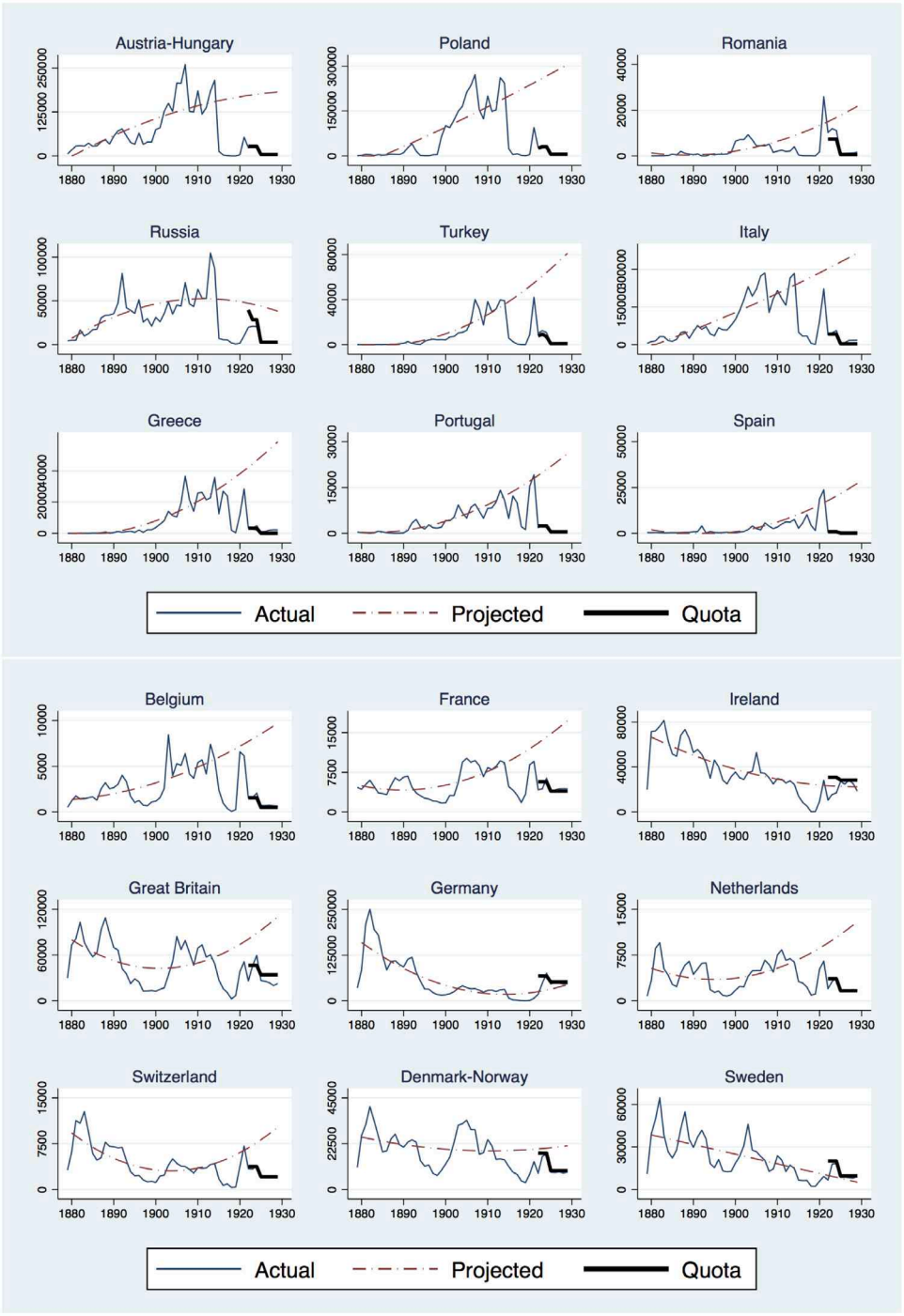
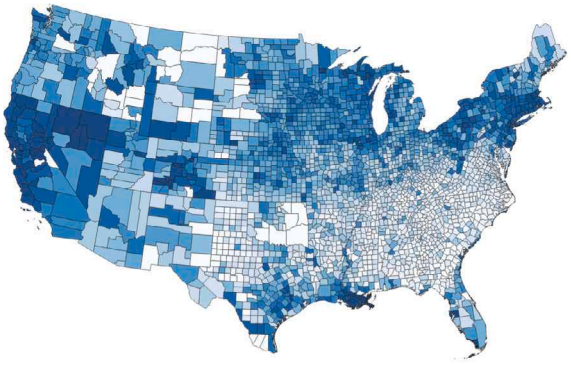


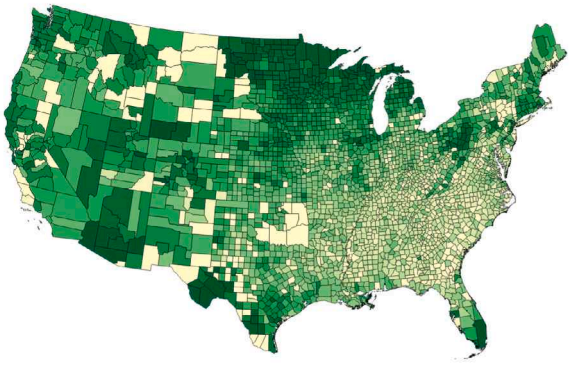
Fig. 2. Actual and projected inflows of immigrants by country.
Note: These figures plot the annual immigrant inflow (navy solid line), the projected immigrant inflow (red dash-dotted line), and the annual quota allotted (in thick black solid line) for each European country. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

y-axis represents the normalized number of excluded immigrants, and the *x*-axis represents the change in immigrant population share between 1920 and 1930. The fitted line indicates a strongly negative correlation between the two variables, with a t-statistic of −27.1.

(a) Excluded immigrant share, 1920–1930



(b) Δimmigrant population share, 1920–1930



(c) Scatterplot and fitted line

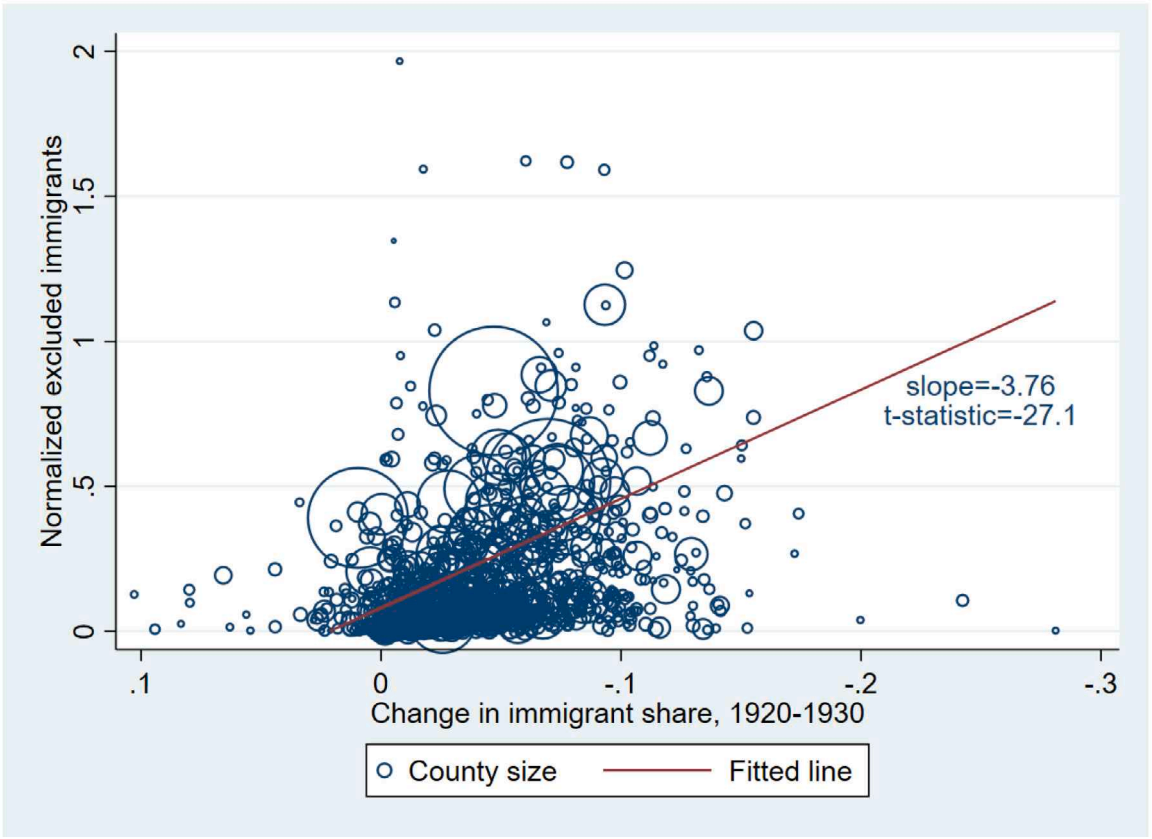


Fig. 3. Instrument relevance.
Note: Fig. 3a plots the normalized number of excluded immigrants in each county, with darker color indicating a higher normalized number of excluded immigrants. Fig. 3b plots the change in immigrant population share between 1920 and 1930, with darker color indicating a greater decline in immigrant population share. Fig. 3c is the scatterplot of all counties, with the change in immigrant population share between 1920 and 1930 on the x-axis, the normalized number of excluded immigrants on the y-axis, and the size of the circle representing the population size of the county. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Exclusion restriction – The exclusion restriction requires that county characteristics that could potentially impact the outcomes should either be uncorrelated with the instrument or explicitly controlled for in the regressions. I empirically examine whether the instrument is associated with the levels and changes of various county characteristics in the pre-quota period. Table 2 presents the estimated coefficients by regressing the levels of county characteristics in 1900 (columns 1 and 2) and the changes between 1900 and 1920 (columns 3 and 4) on the instrument. Naturally, more excluded immigrants are associated with a higher immigrant

Table 2
Exclusion restriction: Instrument and pre-quota county characteristics.

Sample	Levels in 1920		Changes 1900–1920	
	All counties (1)	North (2)	All counties (3)	North (4)
Immigrant population share	0.325***	0.338***	0.011	0.016
	(0.053)	(0.055)	(0.043)	(0.046)
Black population share	0.004	0.004	0.008	0.011
	(0.016)	(0.016)	(0.008)	(0.008)
Literate population share	−.0031***	−.0036***	0.008	0.010
	(0.008)	(0.007)	(0.013)	(0.013)
Manufacturing employment share	0.001	−0.006	−.0030**	−.0030*
	(0.037)	(0.038)	(0.015)	(0.016)
Number of establishments, log	0.207	−0.015	0.157	0.150
	(0.142)	(0.090)	(0.118)	(0.116)
Average manufacturing wages, log	−0.018	−0.019	−0.089**	−0.046
	(0.048)	(0.054)	(0.034)	(0.029)
Industrial employment composition				
Food and kindred products	0.017**	0.015	−0.001	0.005
	(0.007)	(0.011)	(0.005)	(0.005)
Textiles and their products	0.063	−0.008	−0.001	−0.001
	(0.043)	(0.044)	(0.022)	(0.018)
Forest products	0.006	0.020	−0.005	−0.007
	(0.041)	(0.034)	(0.008)	(0.010)
Paper and allied products	−0.008	−0.007	−0.003	−0.002
	(0.009)	(0.010)	(0.006)	(0.006)
Printing and publishing	0.011	0.014	0.004	0.002
	(0.009)	(0.010)	(0.002)	(0.002)
Chemical and allied products	−0.005	−0.003	−0.002	−0.000
	(0.003)	(0.003)	(0.003)	(0.003)
Petroleum and coal products	−0.002	−0.002	−0.007**	−0.008**
	(0.006)	(0.004)	(0.003)	(0.003)
Rubber products	−0.050	−0.049	−0.004	0.002
	(0.044)	(0.040)	(0.008)	(0.008)
Leather products	−0.050	−0.048	−0.004	−0.002
	(0.031)	(0.032)	(0.006)	(0.008)
Stone, clay, and glass products	0.006	0.008	0.003	0.005
	(0.007)	(0.011)	(0.009)	(0.006)
Iron and steel products	0.012	0.004	0.001	−0.003
	(0.022)	(0.025)	(0.008)	(0.010)
Nonferrous metals	0.007	0.008	0.002	0.012
	(0.008)	(0.010)	(0.007)	(0.009)
Machinery	−0.007	0.008	0.006	0.005
	(0.032)	(0.036)	(0.007)	(0.007)
Transportation equipment	−0.098**	−0.082*	−0.019	−0.024
	(0.044)	(0.043)	(0.021)	(0.021)
Railroads and railways	0.036	0.078**	0.001	−0.009
	(0.039)	(0.036)	(0.011)	(0.014)
Miscellaneous industries	0.062	0.044	0.029**	0.025*
	(0.041)	(0.035)	(0.013)	(0.014)

Note: Columns 1 and 2 report the estimated coefficients from regressing the level of the indicated county-level variable in 1920 on the instrument, controlling for state fixed effects. Columns 3 and 4 report the estimated coefficients from regressing the change of the indicated county-level variable between 1900 and 1920 on the instrument, controlling for state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

population share in 1920, but they are not associated with the pre-quota change in immigrant share. The instrument is not correlated with either the pre-quota level or change of the black population share. While the instrument weakly correlates with the change in manufacturing wages in the full sample, this correlation diminishes when focusing on northern counties. Because Southern and Eastern Europeans were generally less educated than the overall population, more excluded immigrants predict a relatively lower literacy rate in 1920. The instrument does not predict the manufacturing employment share but is associated with the pre-quota change in the manufacturing share. Counties more affected by the quota also had a slightly different manufacturing structure with a lower employment share of capital-intensive industries in 1920. Overall, the instrument is uncorrelated with pre-quota levels or trends of most county characteristics that may confound the causal inference. To enhance the validity of the IV estimation, I incorporate county characteristics correlated with the instrument as control variables in the regressions, including the literacy rate, industrial composition in 1920, and the pre-trends of manufacturing employment share and manufacturing wages.

Table 3
Aggregate effect of immigration shock on manufacturing wages.

Dependent variable	ΔLn(average manufacturing wage), 1920–1930					
Sample	All counties			Northern counties		
	OLS	Instrumental variable		OLS	Instrumental variable	
	(1)	(2)	(3)	(4)	(5)	(6)
ΔImmigrant-to-native ratio	−0.010	0.132		0.014	0.120	
	(0.101)	(0.201)		(0.124)	(0.222)	
		First stage	*Reduced form*		*First stage*	*Reduced form*
# of excluded immigrants, normalized		−0.169***	−0.023		−0.154***	−0.019
		(0.029)	(0.032)		(0.032)	(0.032)
First-stage F-statistics		37.2			24.9	
R^2	0.397	0.392	0.398	0.451	0.448	0.452
Observations	2263	2263	2263	1326	1326	1326

Note: This table reports the OLS, 2SLS, and reduced-form estimates from the county-level first-difference regression specification of Eq. (5). Columns 1–3 use the sample of all counties, and columns 4–6 uses the sample of northern counties. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

4.2. The aggregate effect on labor market outcomes

Table 3 presents the estimates from the county-level first-difference regression specification of Eq. (5) using average manufacturing wages as the outcome. The regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the manufacturing industrial composition in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. The regressions are weighted by the county's manufacturing employment size, and the standard errors are clustered at the state level (Solon et al., 2015). The OLS estimate from the regression of the full sample (column 1) is −0.01 and statistically insignificant, indicating no correlation between the immigrant population share and manufacturing wages. Columns 2 presents the 2SLS estimates using the normalized number of excluded immigrants as the instrument. The first-stage estimate is negative and statistically significant at the 1% level, and the F-statistic of 37.2 indicates its strong statistical power. The coefficient suggests that a 1-percentage-point increase in the number of excluded immigrants relative to county's population decreases the immigrant population share by 0.17 percentage point. The 2SLS estimate is 0.132, slightly larger than the OLS estimate but statistically insignificant, indicating no substantial impact of the immigration shock on average manufacturing wages. Column 3 presents the reduced-form estimate, which provides a straightforward interpretation of the wage effect of immigration restrictions. The reduced-form estimate also indicates that the exclusion of immigrants by the quota system did not affect the average wage level.

Given that immigrants predominantly settled in the northern industrialized areas and the North–South labor market segmentation (Rosenbloom, 1996), columns 4–6 presents the estimates from the same regressions using the sample of counties in northern states. The estimates in columns 4–6 are highly consistent with those in columns 1–3, showing that the immigration shock had no impact on wages when focusing solely on the North.

Table 4 reports the 2SLS and reduced-form estimates from the same regression specification using the average occupational income scores of US-born whites, immigrants, and US-born blacks as the outcomes. Columns 1–3 use the sample of all counties and columns 4–6 use the sample of northern counties. The estimates are positive and statistically significant at the 1% level in columns 1, 2, 4, and 5, indicating that the decline in immigrant population share decreased the occupational standing of US-born white and immigrant workers. A 1-percentage-point decrease in immigrant population share reduces the average occupational income score of US-born whites by 0.18% to 0.20% and that of immigrants by 0.14% to 0.16%. On the other hand, the estimated effect on the average occupational income score of blacks are negative but only marginally significant in columns 3 and 6.[38] This finding suggests that the decline in immigrant population share did not reduce the average occupational income score of US-born blacks. The reduced-form estimates also reveal that US-born white and immigrant workers experienced a greater decline in occupational income scores in counties more affected by the quotas, whereas US-born blacks did not.

The results in Tables 3 and 4 indicate that the decline in immigration due to the quota system did not raise the average manufacturing wages and even lowered the occupational standings of US-born whites and immigrants.[39] On the other hand, US-born blacks were largely unaffected by the exclusion of immigrants by the quota system. These findings suggest the existence of labor market adjustments, which led to a negligible aggregate wage response to the adverse labor supply shock and differing effects across various groups. To illustrate potential adjustment mechanisms, I present a simple model in the Appendix that characterizes how labor market equilibrium changes in response to an immigrant labor shock. US-born whites, immigrants, and US-born blacks

[38] The estimated coefficient becomes largely statistically insignificant when I apply instruments constructed from alternative projection methods (Table B.7).
[39] In addition, I estimate the wage elasticity to the supply of immigrant labor using a modified specification of Eq. (5) by replacing the immigrant population share with the natural log of immigrant and native population. Online Appendix Table B4 presents the estimates, which are consistent with Tables 3 and 4.

Table 4
Aggregate effect of immigration shock on occupational standing.

Dependent variable	ΔLn(average occupational income score), 1920–1930					
Sample	All counties			Northern counties		
	US-born whites (1)	Immigrants (2)	US-born blacks (3)	US-born whites (4)	Immigrants (5)	US-born blacks (6)
Panel A. 2SLS						
ΔImmigrant-to-native ratio	0.195***	0.144***	−0.195*	0.184***	0.158***	−0.186*
	(0.033)	(0.041)	(0.115)	(0.037)	(0.037)	(0.105)
Panel B. Reduced-form						
# of excluded immigrants, normalized	−0.035***	−0.026**	0.037*	−0.031***	−0.026***	0.033**
	(0.006)	(0.010)	(0.019)	(0.005)	(0.008)	(0.016)
Observations	2537	2485	2239	1483	1483	1204

Note: This table reports the 2SLS and reduced-form estimates from the county-level first-difference regressions of Eq. (5). Columns 1–3 use the sample of all counties. Columns 4–6 use the sample of northern counties. The dependent variable is the difference in the natural logarithm of the average occupational income score of the corresponding group of workers in a county between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

constitute the aggregate labor in a Cobb–Douglas production function. Immigrants and blacks are assumed to be low-skilled perfect substitutes, while whites are high-skilled and substitute to immigrants or blacks with a constant elasticity. The prediction of the model is that the equilibrium wage response to an immigration shock is attenuated toward zero when the labor supply of natives (either whites or blacks) is elastic enough to substitute for immigrants (Eq. (A.12)).

Skill Categorization by Origin of Immigrants and Literacy status – The model also illustrates differentiated effects of the immigration shock on high- and low-skilled labor. A negative low-skilled labor shock is likely to have a more negative impact on the wages of high-skilled labor compared to low-skilled labor, owing to the complementarity between these two groups (Eqs. (A.13) and (A.14)). To empirically test this prediction, I first showcase the average literacy rate and the share of high-skilled occupations in 1920 among US-born whites, blacks, and immigrants by origin in Fig. B.3.[40] The figure indicates that: (1) Southern and Eastern Europeans and the blacks exhibited markedly lower literacy rates and shares of high-skilled workers in 1920 compared to US-born whites; (2) immigrants from Great Britain, Northern Europe, Western Europe, and Canada showed literacy rates and shares of high-skilled workers that were comparable to those of US-born whites.[41] Such a comparison suggests that Southern and Eastern European immigrants and US-born blacks (and Irish immigrants) were predominantly engaged in low-skilled labor roles during the 1920s and viewed as close substitutes in the workforce. On the other hand, US-born whites and other immigrants were relatively high-skilled labor, complementing those excluded immigrants who were primarily low-skilled.

Using the county-level first-difference regression of Eq. (5), I estimate the effect of the immigration shock on the average occupational income score of immigrants disaggregated by origin. The 2SLS estimates in Table 5 show that the negative immigration shock did not significantly affect the occupational income scores of Southern European, Eastern European, and Irish immigrants (columns 1–3). On the other hand, it decreased the occupational income scores of British, Northern European, Western European, and Canadian immigrants (columns 4–7). These results closely align with the skill categorization of immigrants based on Fig. B.3 and empirically supports the theoretical prediction: as the quota system excluded immigrants who were primarily low-skilled, the immigration shock more negatively affected the labor market outcomes of high-skilled labor relative to low-skilled labor.

Alternatively, I use literacy status as an indicator of skill level to estimate the effect on the average occupational income scores of literate and illiterate workers (Table 6). The estimates show that the immigration shock significantly lowered the average occupational income score of literate workers, who are considered relatively high-skilled, but had no significant impact on that of illiterate workers. Although the literacy rate may not be an ideal indicator of skill since over 93% of adults in the 1920 census were literate, the results still align with the prediction that the immigration shock more adversely affected the occupational standings of high-skilled workers compared to low-skilled workers. Overall, the findings from the empirical analysis by skill group are strongly consistent with the theoretical model.[42]

Occupational distribution – Given how the occupational income score is constructed, it is important to interpret changes in this score as indicators of occupational mobility rather than as direct changes in wages. A related concern is that US-born whites who

[40] Based on the 1950 occupational code, I define high-skilled occupations as codes 1–599, low-skilled occupations as codes 600–969, and non-occupations as codes above 969.

[41] Irish immigrants are an exception with literacy rates similar to those of US-born whites but a high-skilled worker share more similar to that of Southern and Eastern Europeans.

[42] In addition, I conduct the heterogeneity analysis to explore whether the effect is more pronounced in sectors and industries with higher concentration of Southern and Eastern European immigrants in 1920 (Online Appendix Tables B5 and B6). The labor market effects across sectors and industries do not exhibit clear disparities, possibly because of the relatively high labor mobility within counties. Nonetheless, the pattern remains robust that high-skilled labor were more adversely affected by the immigration shock relative to low-skilled labor.

Table 5
Occupational standing of immigrants by origin.

Dependent variable	ΔLn(average occupational income score), 1920–1930						
Origin of immigrants	Southern Europe (1)	Eastern Europe (2)	Ireland (3)	Great Britain (4)	Northern Europe (5)	Western Europe (6)	Canada (7)
ΔImmigrant-to-native ratio	−0.003	0.030	0.021	0.205***	0.185*	0.191***	0.334***
	(0.100)	(0.050)	(0.090)	(0.061)	(0.094)	(0.058)	(0.103)
Observations	1787	2238	1792	2202	1901	2270	2056

Note: This table reports the 2SLS estimates from the county-level first-difference regressions of Eq. (5) using the sample of all counties. The dependent variable is the difference in the natural logarithm of the average occupational income scores of the corresponding immigrant group in a county between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table 6
Occupational standing by literacy status.

Dependent variable	ΔLn(average occupational income score), 1920–1930	
Literacy status	Literate (1)	Illiterate (2)
ΔImmigrant-to-native ratio	0.181***	0.086
	(0.027)	(0.071)
Observations	2537	2535

Note: This table reports the 2SLS estimates from the county-level first-difference regressions of Eq. (5). The dependent variable is the difference in the natural logarithm of the average occupational income scores of literate workers or illiterate workers in a county between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

experienced occupational downgrading might have nonetheless seen wage increases by transitioning into occupations that were previously low-paying but became more lucrative after the exclusion of immigrants. Theoretically, this phenomenon implies that previously high-paying occupations held by high-skilled labor saw a relative wage decline compared to previously low-paying occupations held by low-skilled labor. If this occurred, it would not contradict the theoretical model or empirical findings, as it still suggests that high-skilled labor experiences a relative loss compared to low-skilled labor. Empirically, I examine the effect of the immigration shock on the occupational distribution to provide a more comprehensive view of its labor market effects.[43] Fig. B.4 shows the occupational distribution by race and origin of immigrants in 1920. Southern and Eastern European immigrants and the blacks disproportionately worked as operatives and unskilled laborers. Table B.2 reports the estimates from the county-level regressions using the population share in each occupational category as the outcome. The negative immigration shock resulted in a higher share of farmers and a lower share of white-collar workers among US-born whites (Panel A columns 1 and 2), with no significant impact on other occupational categories. This indicates that they did not substantially move into occupations previously held by excluded immigrants. Panel B demonstrates a similar impact of the immigration shock on the occupational distribution among existing immigrants, as well as shifts within low-skilled occupations. Notably, for US-born blacks, the negative immigration shock led to a higher share of operatives and white-collar workers (Panel C columns 1 and 4). In particular, column 6 shows that the immigration shock did not affect the average share of non-occupations. Presumably, elastic labor supply substitution could occur through the expansion of the labor force. This finding indicates that labor force entry is unlikely to be a major adjustment mechanism.

4.3. Internal migration as labor substitution

Given the weak wage response to the immigration shock and the absence of evidence for an expanded labor pool, I propose that internal migration, acting as a form of labor substitution, hindered the potential increase in wages following the exclusion of immigrants. To empirically examine this mechanism, I estimate the effect of the immigration shock on the internal migration of US-born whites, immigrants, and US-born blacks using the county-level first-difference regression model of Eq. (5). The dependent

[43] Based on the 1950 occupational code, I define six broad occupational categories: white collars (codes 1–99; 200–499), farmers (codes 100–199), craftsmen (codes 500–599), operatives (codes 600–799), unskilled laborers (codes 700–969), and non-occupations (codes above 969).

Table 7
Immigration shock and labor substitution: Internal migration.

Dependent variable	Ln(# of in-migrants)			
	All	US-born white	Immigrants	US-born black
	(1)	(2)	(3)	(4)
Panel A. 2SLS				
ΔImmigrant-to-native ratio	−8.530***	−7.028***	−16.250***	−11.910***
	(2.192)	(2.147)	(2.586)	(3.077)
R^2	0.559	0.562	0.582	0.601
Observations	2537	2537	2298	2389
Panel B. Reduced-form				
# of excluded immigrants, normalized	1.524***	1.255**	2.884***	2.233***
	(0.538)	(0.499)	(0.593)	(0.810)
R^2	0.554	0.552	0.583	0.616
Observations	2537	2537	2298	2389
Panel C. Rate of substitution				
# of migrants to # of excluded immigrants	0.60	0.39	0.15	0.07
% of migrants to % of excluded immigrants	0.60	0.56	0.77	0.64

Note: This table reports the 2SLS and reduced-form estimates from the county-level first-difference regression specification of Eq. (5). The dependent variable is the natural logarithm of the number of internal migrants into a county between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Panel C reports the rate of substitution of each group. The first measure is the increase in the number of internal migrants with one additional excluded immigrant. The second measure is the increase in migrants into a county relative to the total population of their group in response to each additional percentage point of excluded immigrants relative to the total county population. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

variable is the natural logarithm of the number of internal migrants (all, US-born white, foreign-born, US-born black) who moved into county i between 1920 and 1930, as identified from the linked census sample.

Table 7 reports the 2SLS and reduced-form estimates. Columns 1–4 use the natural logarithm of the number of all, US-born white, foreign-born, and US-born black internal migrants into a county between 1920 and 1930 as the dependent variable, respectively. The 2SLS estimates in Panel A show that counties that experienced a sharper decline in immigrant population experienced a greater inflow of internal migrants. The reduced-form estimates in Panel B also reveal that counties with more immigrants excluded attracted more internal migrants. A 1-percentage-point increase in the number of excluded immigrants relative to county's population increases the inflow of internal migrants by 1.3% to 2.9%. To gauge the magnitude of such labor substitution, I calculate and present two measures of "rate of substitution" for each group of internal migrants in Panel C. The first measure is defined as the increased number of internal migrants moving into a county in response to the exclusion of one additional immigrant.[44] The rate of substitution for all, US-born white, foreign-born, and US-born black migrants are 0.60, 0.39, 0.15, and 0.07, respectively. The rate of substitution indicates that labor supply is relatively elastic, with internal migration effectively substituting for immigrant labor. The second measure calculates the increase in migrants relative to the total population of their group in 1920 (e.g., the increased number of black migrants divided by the county's black population) in response to each additional percentage point of excluded immigrants relative to the total county population. This measure delivers an elasticity-like interpretation to compare the responsiveness to labor supply shock across different groups. The rate is higher among foreign-born and black migrants, suggesting that they were more responsive to changes in local labor supply and more likely to move into affected counties as substitutes for excluded immigrants. This finding aligns with Cadena and Kovak (2016) who show that low-skilled Mexican immigrants were highly responsive to changes in local labor market conditions.

4.4. Labor market outcomes of non-movers and in-migrants

Considering the sizable internal migration triggered by the immigration shock, it is highly probable that the immigration restrictions caused a distributional effect on the labor market outcomes of non-movers and in-migrants. I use the linked individual samples to examine the heterogeneous effect of the immigration shock on the occupational income scores of non-movers and in-migrants. The individual-level first-difference regression specification is as follows:

$$\Delta \ln w_{ji} = \theta \Delta I_i + \Delta X_i \beta + M_i \Delta \xi + \Delta \gamma_s + c + \Delta \epsilon_j \tag{6}$$

where $\Delta \ln w_{ji}$ is the difference in the natural logarithm of the occupational income score between 1920 and 1930 of individual j who lived in county i in 1930. A "non-mover" is defined as an individual who lived in county i in both 1920 and 1930, while an "in-migrant" is defined as an individual who lived in a different county in 1920 and showed up in county i in 1930. The control variables

[44] This rate is calculated based on the reduced-form estimates, the average county population in 1920, and the average number of internal migrants between 1920 and 1930. For instance, a 1-percentage-point increase in the normalized number of excluded immigrants (138 persons), increases the number of all internal migrants by 1.542% (83 persons), resulting in a substitution rate of 0.6.

Table 8
Distributional effect on individual occupational standing.

Dependent variable	ΔLn(Individual occupational income score), 1920–1930					
	US-born white		Immigrants		US-born black	
	Non-movers (1)	In-migrants (2)	Non-movers (3)	In-migrants (4)	Non-movers (5)	In-migrants (6)
ΔImmigrant-to-native ratio	0.098***	−0.769***	0.048	−0.442**	−0.167	−0.509
	(0.031)	(0.103)	(0.057)	(0.213)	(0.182)	(0.382)
	First stage					
# of Excluded immigrants, normalized	−0.150***	−0.162***	−0.157***	−0.172***	−0.105***	−0.127***
	(0.016)	(0.015)	(0.028)	(0.026)	(0.020)	(0.024)
Kleibergen–Paap rk F-stats.	88.1	120.0	34.6	45.3	26.3	27.1
Observations	3 299 174	1 943 985	472 932	359 297	132 333	214 418

Note: This table reports the 2SLS and reduced-form estimates from the individual-level first-difference regressions of Eq. (6) using the linked census samples. The dependent variable is the difference in the natural logarithm of the individual occupational income score between 1920 and 1930. "Non-movers" are individuals who lived in the same county in 1920 and 1930. "In-migrants" are individuals who moved into this county between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the county level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

are the same as in Eq. (5). To address the issue of selection into matching, the regression is weighted by the individual's inverse probability weight based on observable characteristics in the 1930 census, ensuring that the linked individuals are representative of the entire population.[45]

Table 8 presents the 2SLS estimates from the regressions of Eq. (6) using the samples of non-movers and in-migrants within US-born whites (columns 1 and 2), immigrants (columns 3 and 4), and US-born blacks (columns 5 and 6). The results indicate that in counties more affected by the immigration shock, white non-movers experienced a more substantial decline in occupational standing: a 1-percentage-point decrease in immigrant population share resulted in a 0.10% decrease in their occupational income scores (column 1). In contrast, a 1-percentage-point decrease in immigrant population share in a county increased the occupational income scores of US-born whites migrating into this county by 0.77% (column 2). This finding suggest a substantial distribution effect of immigration restrictions on the wages of US-born white non-movers and migrants. The occupational standings of foreign-born and US-born black non-movers were not substantially affected by the immigration shock (columns 3 and 5). Foreign-born migrants to counties more affected by the immigration shock also experienced a greater gain in occupational standing (column 4). On the other hand, the immigration shock had no significant effect on the occupational standing of US-born black migrants (column 6). It is worth noting that the coefficient measures the *relative* gain (or loss) of migrants to counties affected by the immigration shock to varying extents. The estimated coefficients of smaller magnitudes for foreign-born and US-born black migrants may indicate their higher labor mobility that more equalized the gains across counties.

In addition, I conduct the individual-level analysis disaggregated by skill level (Table B.3). Columns 1–4 present the estimated effects on non-movers and in-migrants among Southern and Eastern European immigrants (low-skilled) and other immigrants (high-skilled).[46] Columns 5–8 present the estimated effects on non-movers and in-migrants among literate workers and illiterate workers. Consistent with the county-level analysis, the results indicate that the immigration shock more adversely affected the occupational standings of high-skilled non-movers compared to low-skilled non-movers (columns 3 and 5), while the difference in gains for migrants across skill groups is not significant.

I also examine the effect of the immigration shock on individual occupational choice of non-movers and in-migrants (Table B.4). Among non-movers in a county, the negative immigration shock caused US-born whites being less likely to hold occupations as white collars and craftsmen and more inclined toward being farmers (Panel A). Immigrants also moved out of occupations as craftsmen and into farming (Panel C). Blacks moved away from unskilled laborers toward white-collar jobs and farmers (Panel E). In counties with a greater immigration shock, white migrants were less likely to be unskilled laborers and more likely to be white-collar workers and operatives (Panel B). Foreign-born migrants transitioned from farmers to operative roles (Panel D), while black migrants shifted from farmers and non-occupations to operative and unskilled laborer roles (Panel E).

4.5. Immigration shock and the Great Black Migration

I further investigate the causal effect of the decline in immigration on the Great Black Migration, which is the most phenomenal internal migration of US-born blacks to northern states during this period. Specifically, I estimate the county-level regression model

[45] Specifically, I regress the binary indicator for successful matching on age, the dummy for literacy, the dummy for urban residence, and occupational income score using a probit model for US-born whites, immigrants and US-born blacks separately. Based on the estimated coefficients, I calculate the predicted probability of being a successful match of each individual, $\hat{P}$, and assign $\frac{(1-\hat{P})P_M}{\hat{P}(1-P_M)}$ to matched observations as their weights, where P_M is the average match rate in the population.

[46] Other immigrants include immigrants from Britain, Northern Europe, Western Europe, and Canada.

Table 9
Immigration shock and the great black migration.

Dependent variable	From unlinked census samples			From linked census samples		
	ΔBlack population share	ΔShare of blacks born in a different state)	ΔShare of blacks born in the South	Ln(# of black migrants)	Ln(# of South-to-North black migrants)	Ln(# of within-North black migrants)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. 2SLS						
ΔImmigrant-to-native ratio	−0.084***	−0.075***	−0.059***	−11.883***	−10.169***	−14.269***
	(0.026)	(0.026)	(0.021)	(2.654)	(2.302)	(2.637)
Panel B. Reduced-form						
# of excluded immigrants, normalized	0.014**	0.012**	0.010**	2.086***	1.808***	2.620***
	(0.006)	(0.006)	(0.004)	(0.588)	(0.501)	(0.684)
Observations	1483	1483	1483	1335	1256	1077

Note: This table reports the 2SLS and reduced-form estimates from the county-level first-difference regression specification of Eq. (5) using the sample of northern counties. The dependent variables in columns 1–3 are the difference in the population shares of all US-born blacks, blacks born in a state different from their state of residence in 1930, and blacks born in a southern state. The dependent variables in columns 4–6 are the natural logarithm of the numbers of all black migrants, blacks who moved from a southern county to a northern county, and blacks who moved within northern counties between 1920 and 1930, identified from the linked census samples. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the black population share in 1920, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

of Eq. (5) using the sample of northern counties, focusing on various outcomes that measure the Great Black Migration. In addition, the regressions control for the black population share in 1920 to account for the "chain migration" effect (Carrington et al., 1996).

In Table 9, columns 1–3 present the 2SLS and reduced-form estimates from county-level regressions using changes in the county-level population share of all US-born blacks, blacks born in a different state, and blacks born in a southern state between 1920 and 1930 as dependent variables. The estimates indicate that the decline in immigration significantly increased the population of US-born blacks in northern counties, with the majority of the growth stemming from an increase in the population of blacks born in the South. Columns 4–6 present the estimates using the natural logarithm of the numbers of black migrants, South-to-North black migrants (who lived in a southern county in 1920 and in a northern county in 1930), and the number of within-North black migrants (identified from the linked census samples) as the dependent variables. The estimates also indicate a strong causal effect of the decline in immigrant population on the inflow of black migrants. The reduced-form estimates suggest that a 1-percentage-point increase in the normalized number of excluded immigrants led to the increases in the population of black migrants by 2.1% and the population of South-to-North migrants by 2.6% (columns 4–5). In particular, column 6 reveal that there was also substantial migration of US-born blacks within northern states.

The results in Table 9 indicate that in response to the decline in immigration caused by the quota system, US-born blacks massively migrated to replace immigrant workers in northern counties that experienced the loss of immigrant workforce. This finding demonstrates a clear causal relationship between immigration restrictions and the Great Black Migration in the 1920s, providing empirical support for the "immigrant-as-deterrent" theory (Thomas, 1972; Collins, 1997). A back-of-the-envelope calculation indicates that immigration restrictions causally increased the black population in northern counties by approximately 61,800 individuals. After accounting for potential endogeneity, this figure is less than half of Collins (1997)'s estimate of 165,000.

4.6. Socioeconomic outcomes of black migrants and non-movers

Using individual-level regression specification of Eq. (6), I first examine the effect of the immigration shock on the occupational standings of black non-movers and migrants residing in northern counties in 1930. Table 10 reports the 2SLS estimates from the regressions using the natural logarithm of individual occupational income score as the outcome. The results show that all US-born blacks on average had higher occupational standings in northern counties affected by the immigration shock (column 1). The decline in immigrant population in a county slightly increased the occupational income score of black non-movers, but the effect is marginal (column 2).[47] On the other hand, the decline in immigrant population substantially increased that of black in-migrants (column 3). A 1-percentage-point decline in a county's immigrant population share increased the occupational income score of black migrants moving into the county by 1.09%. Among black migrants, migrants who moved within the North experienced a relatively larger gain than those who migrated from the South to the North (columns 4 and 5).

I further explore the effect of the immigration shock on various socioeconomic outcomes of blacks in the North. Table B.6 presents the average characteristics of black migrants and non-movers in 1920 and 1930. The summary statistics show that black migrants became more literate and urban residing, worked less in agriculture and more in manufacturing, and held more high-skilled

[47] The estimated coefficient becomes largely statistically insignificant when I apply instruments constructed from alternative projection methods (Table B.7).

Table 10
Occupational standing of US-born blacks in the north.

Dependent variable	ΔLn(individual occupational income score), 1920–1930				
Sample	All	Non-movers	In-migrants	South-to-North migrants	Within-North migrants
	(1)	(2)	(3)	(4)	(5)
ΔImmigrant-to-native ratio	−0.855***	−0.322*	−1.094***	−0.680**	−1.215***
	(0.168)	(0.167)	(0.231)	(0.271)	(0.246)
	First stage				
# of excluded immigrants, normalized	−0.223***	−0.235***	−0.216***	−0.220***	−0.211***
	(0.025)	(0.025)	(0.025)	(0.027)	(0.024)
Kleibergen–Paap rk F-stats.	91.7	105.0	88.7	75.2	89.6
Observations	108 439	39 635	68 804	38 091	30 713

Note: This table reports the 2SLS estimates from the individual-level first-difference regression specification of Eq. (6). The dependent variable is the difference in the natural logarithm of individual occupational income score between 1920 and 1930. Column 1 uses the linked individual sample of all US-born blacks in northern counties in 1930. Column 2 uses the sample of blacks who lived in the same northern county in 1920 and 1930. Column 3 uses the sample of blacks who migrated to a northern county between 1920 and 1930. Column 4 uses the sample of blacks who migrated from a southern county to a northern county between 1920 and 1930. Column 5 uses the sample of blacks who lived in different northern counties in 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the county level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

occupations after migration (columns 1 and 2). On the other hand, black non-movers in the North became less likely to work in agriculture and manufacturing, and also held more high-skilled occupations from 1920 to 1930.

Table 11 reports the 2SLS estimates from the individual-level regressions of Eq. (6) that use the dummies for literacy status, urban residence, employment in agriculture and manufacturing, and six occupational categories as the outcomes. The estimates in Panel A show that black migrants in northern counties more affected by the immigration shock were more literate, resided in urban areas, worked in manufacturing, and held more white-collar and operative jobs. Panel B shows that black non-movers in more affected counties held more high-skilled occupations and less likely to work in agriculture. The results indicate that US-born black migrants and non-movers in northern counties gained from the decline in immigration. In particular, black migrants experienced greater economic gains and an increased likelihood of being literate by migrating to northern counties with more excluded immigrants. Consistent with Collins and Wanamaker (2014), who find significant economic gains for black migrants, this finding further connects their gains to the decline in immigration.

I additionally examine the effect of the immigration shock on the occupational income scores of black non-movers in the South and white southerners to the North (Table B.5). The coefficient in column 1 indicates that the negative immigration shock decreased the occupational standings of black non-movers in the South, but the estimate lacks statistical significance due to the limited statistical power of the instrument within southern states. White southerners moving to northern counties also notably benefited from moving into counties where immigrants were excluded (column 2).

4.7. Immigration shock and manufacturing production

Aside from the labor substitution to immigrant labor, adjustments in production also affect the wage response to the immigration shock. If firms can adjust capital input flexibly, the labor demand curve becomes flatter and the wage response is less sensitive to the immigration shock (Eqs. (A.7) and (A.12)). Did manufacturing firms also adjust their production in response to the decline in immigration in this period? I use the regression specification identical to the wage regression of Eq. (5) to examine the effects of the immigration shock on the input decisions of manufacturing firms.[48] The outcomes include wage workers per establishment as the proxy for labor input, horsepower per establishment as the proxy for capital input, horsepower per wage worker as the proxy for capital-to-labor ratio, value added per wage worker as the proxy for labor productivity, value added per establishment as the proxy for total output, and number of establishments as the entry and exit of firms.

Table 12 presents the 2SLS and reduced form estimates. The estimates suggest that a 1-percentage-point decrease in immigrant population share reduced employment and horsepower per manufacturing establishment by 1.6% and 1.7%, while the capital-to-labor ratio remained unchanged. The decline in immigration also reduced the total output of firms: value added per establishment also decreased by 2.0% in response to a 1-percentage-point decline in immigrant share (column 4). Labor productivity, indicated by value added per wage worker, was unaffected (column 5). Additionally, the decline in immigration slightly encouraged the entry of manufacturing establishments: a 1-percentage-point decrease in the share of immigrants increases the number of establishments by about 1.1% (column 6).

[48] This regression model corresponds to Eqs. (A.15) and (A.16) in the theoretical model.

Table 11
Various socioeconomic statuses of US-born blacks in the north.

	Dependent variable: ΔY, 1920–1930											
	Literacy	Urban residence	Agricultural sector	Manufacturing sector	High-skilled occupation	Low-skilled occupation	White collar	Farmer	Craftsman	Operative	Unskilled laborer	Non-occupation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: In-migrant sample												
ΔImmigrant-to-native ratio	−1.212***	−0.368***	0.916***	−0.393**	−0.051	−0.361	−0.160***	0.172*	−0.063	−0.372**	0.011	0.412*
	(0.355)	(0.124)	(0.229)	(0.170)	(0.129)	(0.221)	(0.057)	(0.092)	(0.066)	(0.149)	(0.243)	(0.215)
Observations	82 500	82 500	82 500	82 500	78 275	78 275	78 275	78 275	78 275	78 275	78 275	78 275
Panel B: Non-mover sample												
ΔImmigrant-to-native ratio	0.206**	−0.222*	0.317**	0.011	−0.403***	0.688***	−0.054	−0.273***	−0.076	−0.021	0.710***	−0.285*
	(0.101)	(0.120)	(0.127)	(0.108)	(0.141)	(0.224)	(0.045)	(0.096)	(0.070)	(0.094)	(0.235)	(0.165)
Observations	45 424	45 424	45 424	45 424	42 844	42 844	42 844	42 844	42 844	42 844	42 844	42 844

Note: This table reports the 2SLS estimates from the individual-level first-difference regression specification of Eq. (6). Panel A uses the linked individual sample of US-born black migrants who migrated to northern counties between 1920 and 1930. Panel B uses the linked individual sample of US-born non-movers who lived in northern counties. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the county level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table 12
Immigration shock and manufacturing production.

	Dependent variable: ΔLn(Y), 1920–1930					
	Workers per establishment	Horsepower per establishment	Horsepower per wage worker	Value added per establishment	Value added per wage worker	Number of establish-ments
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 2SLS						
ΔImmigrant-to-native ratio	1.615***	1.747***	0.132	2.013***	0.399	−1.123***
	(0.253)	(0.349)	(0.239)	(0.471)	(0.313)	(0.269)
Panel B: IV Reduced-form						
# of excluded immigrants, normalized	−0.276***	−0.299***	−0.023	−0.345***	−0.068	0.192***
	(0.037)	(0.045)	(0.040)	(0.040)	(0.045)	(0.048)
Observations	2263	2263	2263	2263	2263	2263

Note: This table reports the 2SLS and reduced-form estimates from the county-level first-difference regression specification of Eq. (5) using the sample of all counties. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

The results indicate that manufacturing firms adjusted both capital and labor inputs in response to the negative labor supply shock. Specifically, the average size of manufacturing establishments decreased, while the number of establishments increased following the negative immigration shock. The ability of manufacturing firms to flexibly adjust their capital input suggests a relatively elastic supply of capital. These production adjustments in manufacturing firms likely mitigated the wage response to the immigration shock.

5. Robustness checks

5.1. Use alternative projection methods to construct the instrument

A concern is that the IV estimates are specific to the projected counterfactual immigrant inflows generated through quadratic curve-fitting. To address this issue, I apply several alternative approaches to predict counterfactual immigrant inflows, including the cubic curve-fitting, the fractional polynomial curve-fitting, the 10-year moving average, and a constant predicted inflow set to the actual inflow in 1921.[49] Table B.7 reports the estimates using instruments constructed from these alternative projections. The results are largely consistent across all methods, aligning with the estimates obtained with the instrument constructed using quadratic curve-fitting. Two exceptions are that the estimated effects on the average occupational income score of blacks from the county-level regressions and on individual occupational income scores of black non-movers become smaller and statistically insignificant in most columns (Panels A and C).

The implication is that the statistical power of the instrument mainly stems from the different intensities of the policy shock to immigration from various countries, particularly between Southern and Eastern European countries and Western and Northern European countries. Despite the variance in projection methods, all these approaches effectively capture the variation in the intensity of immigration restrictions on sending countries imposed by the quota system.

5.2. Check for first-stage spurious correlation

Clemens and Hunt (2019) cautions that in immigration studies using the shift-share instrument, a shared denominator in the regressor and regressand of the first-stage regression may create a spurious correlation, overstating the instrument's statistical power. To address the potential issue of first-stage spurious correlation, I construct a placebo instrument by assigning a random number of excluded immigrants to each county generated from a uniform distribution with the mean of the excluded immigrants projected with quadratic curve-fitting. Fig. B.5 plots the histogram of the estimated coefficients by regressing the change in the share of immigrants on the placebo instruments based on 2000 iterations. The estimates are weakly positive and centered around 0.08, contrasting with the estimated coefficient on the true instrument, which is approximately −0.19 (red line). The placebo test indicates that the numerator in the instrument, i.e. the number of excluded immigrants, is essential to the first-stage correlation and that the statistical power of the instrument is not driven by the correlation between the denominators.

[49] The 10-year moving average is based on pre-quota immigrant inflows (1879–1914). The fractional polynomial method searches through a given set of powers for the best-fitting model based on the Akaike Information Criterion (Royston and Altman, 1994), which includes standard quadratic and cubic curve-fittings as a subset. Figures B5–B8 in the Online Appendix plot the projected inflows based on these methods.

5.3. Drop counties with most excluded immigrants

One might question whether the estimates from the county-level regressions are influenced by a handful of heavily populated counties with large numbers of excluded immigrants, such as New York. To address this concern, I estimate the effect of the immigration shock on various outcomes after excluding counties with numbers of excluded immigrants in the 99th percentile. The results, reported in Online Appendix Table B8, indicate that excluding these counties from the estimation does not significantly affect the point estimates or the standard errors of the coefficients. This suggests that the main findings are robust and are unlikely to be driven by a few outlier counties with exceptionally large immigrant populations.

6. Concluding remarks

The US immigration quota system established in the 1920s severely limited immigration to the US and disproportionately reduced the inflows of immigrants from Southern and Eastern Europe. Although the quota system was initially intended to protect the economic welfare of native workers (Goldin, 1994), my findings show that the immigration decline induced by the quota system did not raise average manufacturing wages and even lower the average occupational standings of US-born whites and incumbent immigrants between 1920 and 1930.

The lack of a wage response to the immigration shock suggests that labor market adjustments absorbed the adverse labor supply impact. Empirical evidence shows that counties affected by the immigration shock saw substantial inflows of internal migrants, indicating that native workers moved to replace immigrant labor in these areas. This internal migration served as an adjustment mechanism, buffering wages from the negative supply shock. Immigration restrictions also led to a significant distributional effect on individual labor market outcome due to internal migration, which is masked in the aggregate wage analysis. For US-born whites, internal migrants who moved to affected counties experienced substantial gains, while non-movers tended to experienced a reduction in occupational standings. These findings contribute new insights to immigration research by underscoring the potential distributional effects of immigration policies.

In particular, I establish a clear causal relationship between the decline in immigration due to the immigration restrictions and the Great Black Migration. US-born blacks from the southern states migrated to northern counties that experienced a decline in immigration to replace immigrant labor, mostly in the manufacturing sector. Black migrants who moved to affected counties were able to achieve higher occupational standings and literacy rate. On the other hand, black non-movers in affected counties also experienced economic gains and held more high-skilled occupations. Immigration restrictions significantly contributed to the Great Black Migration by encouraging black southerners to move out of southern states, which brought them notable economic gains. In this regard, the immigration quota system, though unintended, enhanced the economic welfare of black migrants.[50]

Appendix A. Theoretical model

Based on the framework proposed by Dustmann et al. (2016), I build a simple theoretical model that characterizes the changes in labor market equilibrium outcomes in response to an exogenous immigration shock with an elastic supply of native labor and an elastic supply of capital.

Production function – The production function of the firm takes the form of the Cobb–Douglas function:

$$Y = AK^{a}[(\theta_m L_m^{\delta} + \theta_n L_n^{\delta})^{1/\delta}]^{1-a} \tag{A.1}$$

The aggregate labor input $L = (\theta_m L_m^{\delta} + \theta_n L_n^{\delta})^{1/\delta}$ is determined by a constant elasticity of substitution (CES) function of the labor input of high-skilled US-born whites, L_n, and the labor input of low-skilled immigrants and US-born blacks, L_m, with an elasticity of substitution of $1/(1-\delta)$. Immigrants and US-born blacks are assumed to be perfect substitutes: $L_m = L_{mi} + L_{mb}$. The product is sold at a fixed world market price that is normalized to 1.

Total differentiating the first-order condition for profit maximization with respect to capital K (and taking log) yields the following:

$$(a-1)d\ln K + (1-a)d\ln L = d\ln r \tag{A.2}$$

Note that the differential of the aggregate labor input (in log) $d\ln L = \phi_m d\ln L_m + \phi_n d\ln L_n$, where $\phi_i = \dfrac{\theta_i L_i^{\delta}}{\theta_m L_m^{\delta} + \theta_n L_n^{\delta}}$ is the share of the input contribution of type-i labor to the aggregate labor input.

Assume that capital K is supplied with a constant price elasticity of γ:

$$d\ln K = \gamma d\ln r \tag{A.3}$$

Substituting Eq. (A.3) into Eq. (A.2), we obtain:

$$\frac{d\ln K}{d\ln L} = 1 + \frac{1}{\gamma(a-1)-1} \tag{A.4}$$

[50] It is noteworthy that the Great Black Migration also had negative effects on black migrants. For instance, Black et al. (2015) show that migration increased the mortality and reduced the longevity of black migrants, likely due to unhealthy behaviors or environmental hazards.

Labor demand – Total differentiating the first-order conditions with respect to labor L_i yields the following:

$$a d \ln K + (1 - \delta - a) d \ln L + (\delta - 1) d \ln L_i = d \ln w_i \tag{A.5}$$

Substituting Eq. (A.4) into Eq. (A.5) yields the demand function for type-i labor as follows:

$$\Psi d \ln L + (1 - \delta)(d \ln L - d \ln L_i) = d \ln w_i \tag{A.6}$$

The aggregate labor demand function is given by:

$$d \ln L = \frac{1}{\Psi} d \ln w \tag{A.7}$$

where $\Psi = \frac{a}{\gamma(a-1)-1} < 0$ and $\frac{1}{\Psi}$ characterizes the firm's elasticity of demand for aggregate labor. When $\gamma \to \infty$, the firm's elasticity of demand for aggregate labor $\frac{1}{\Psi} \to -\infty$.

Labor supply – Assume that the labor supply of immigrants is inelastic. The labor supply elasticity of US-born whites and US-born blacks is β:

$$d \ln L_n = \beta d \ln w_n \tag{A.8}$$

$$d \ln L_{mb} = \beta d \ln w_m \tag{A.9}$$

Suppose that there is an exogenous shock to the labor supply of immigrants ΔS_{mi}, the supply function of type-i labor is given by:

$$d \ln L_i = d I_i + \beta d \ln w_i \tag{A.10}$$

where $d I_m = \frac{\Delta S_{mi}}{L_{mb}}$ and $d I_n = 0$. The aggregate labor supply function is given by:

$$d \ln L = \phi_m d \ln L_m + \phi_n d \ln L_n = d I^E + \beta d \ln w \tag{A.11}$$

where $d I^E = \phi_m d I_m$ is the aggregate immigration shock (as efficient units) and the change in the average wage (in log) is $d \ln w = \phi_m d \ln w_m + \phi_n d \ln w_n$.

Labor market equilibrium – Substituting Eqs. (A.10) and (A.11) into Eqs. (A.6) and (A.7), we can derive the labor market equilibrium in response to the immigration shock described as the following equations:

$$d \ln w = \frac{\Psi}{1 - \beta\Psi} d I^E \tag{A.12}$$

$$d \ln w_i = \frac{\Psi}{1 - \beta\Psi} d I^E + \frac{1 - \delta}{1 - \beta(\delta - 1)} (d I^E - d I_i) \tag{A.13}$$

Eq. (A.12) shows that the aggregate response of the equilibrium wage to the immigration shock is $\frac{\Psi}{1-\beta\Psi}$, whose direction is jointly determined by the firm's labor demand elasticity and the elasticity of labor supply. When $1 - \beta\Psi > 0$, the equilibrium wage decreases in the face of a positive immigration shock. Note that the change in the equilibrium wage in response to the immigration shock tends to be zero if $\Psi \to 0$ (when $\gamma \to \infty$) or if $\beta \to \infty$. The economic interpretation is that the total effect of the immigration shock on the equilibrium wage is attenuated by the elasticity of the supply of capital and native labor. The average equilibrium wage level will not be affected by the immigration shock if the supply of capital or native labor is perfectly elastic.

Eq. (A.13) suggests that the total effect of the immigration shock on the equilibrium wage of type-i labor is also affected by the second term $\frac{1-\delta}{1-\beta(\delta-1)}(d I^E - d I_i^E)$ in addition to the aggregate response ($\frac{\Psi}{1-\beta\Psi} d I^E$). Intuitively, the second term characterizes the relative effect due to complementarity between the different types of labor, as the immigration shock is assumed to affect type-m (low-skilled) labor. Provided that the labor supply of natives is not perfectly elastic, the second term is non-zero and has different signs for different types of labor.

When there is a negative immigration shock, this relative effect for type-n labor (high-skilled US-born whites) is negative, as $\frac{1-\delta}{1-\beta(\delta-1)} > 0$ and $d I^E - d I_n^E = \phi_m d I_m < 0$, indicating that the negative immigration shock *relatively* lowers the wages of US-born whites in addition to the aggregate wage effect (from the first term). On the other hand, the relative effect for type-m labor (low-skilled immigrants and US-born blacks) is positive, as $d I^E - d I_m^E = (\phi_m - 1) d I_m > 0$, indicating that the negative immigration shock *relatively* increases the wages of immigrants and US-born blacks in addition to the aggregate wage effect.

Substituting Eq. (A.13) into Eq. (A.9) yields the following:

$$d L_{mb} = [\phi_m (\frac{1}{1 - \beta\Psi} - \frac{1}{1 - \beta(\delta - 1)}) + \frac{\beta(\delta - 1)}{1 - \beta(\delta - 1)}] \Delta S_{mi} \tag{A.14}$$

Eq. (A.14) demonstrates the substitution of labor supply between immigrants and US-born blacks in response to the immigration shock. If there is a negative immigration shock ($\Delta S_{mi} < 0$), we observe an increase in the labor supply of US-born blacks. When the labor supply of natives becomes more elastic, the labor supply response of US-born blacks to the immigration shock approaches −1, indicating a 1:1 substitution ratio between US-born blacks and immigrants.

Substituting Eq. (A.12) into Eq. (A.7) and Eq. (A.4) yields the following:

$$d \ln L = \frac{1}{1-\beta\Psi} d I^E \tag{A.15}$$

$$d \ln K = [1 + \frac{1}{\gamma(a-1)-1}] \frac{1}{1-\beta\Psi} d I^E \tag{A.16}$$

Eqs. (A.15) and (A.16) demonstrate the adjustments in labor and capital inputs of firms in response to the immigration shock. Eqs. (A.15) shows that firms' labor input response to the immigration shock, $\frac{1}{1-\beta\Psi}$, is between 0 and 1. If the labor supply of natives is perfectly elastic ($\beta \to \infty$), firms do not adjust their labor and capital inputs, as native workers completely replace immigrants. Given the partial substitution of natives for immigrants, $\frac{1}{1-\beta\Psi}$ approaches 1 when the supply of capital becomes more elastic ($\Psi \to 0$), which indicates that the reduction in labor input is more sensitive to the negative immigration shock. Eq. (A.16) likewise shows that the capital input response to the immigration shock, $[1 + \frac{1}{\gamma(a-1)-1}] \frac{1}{1-\beta\Psi}$, is also between 0 and 1. When the supply of capital is more elastic, the capital reduction becomes more sensitive to the negative immigration shock as the term $[1 + \frac{1}{\gamma(a-1)-1}] \frac{1}{1-\beta\Psi}$ approaches 1.

Note also that the ratio $[1 + \frac{1}{\gamma(a-1)-1}]$ reflects the change in the capital-to-labor ratio (capital intensity) as shown by Eq. (A.4). This ratio approaches 1 when $\gamma \to \infty$, indicating that capital-to-labor ratio tends to not change in response to the immigration shock input if the supply of capital is fully elastic.

The setting above assumes a constant labor supply elasticity across US-born blacks and US-born whites. The model can be extended with different labor supply elasticities across different groups, which yields more complex expressions for the wage responses but does not change the predictions of the model.

Appendix B. Additional figures and tables

See Fig. B.1 to Fig. B.5 and Table B.1 to Table B.7.

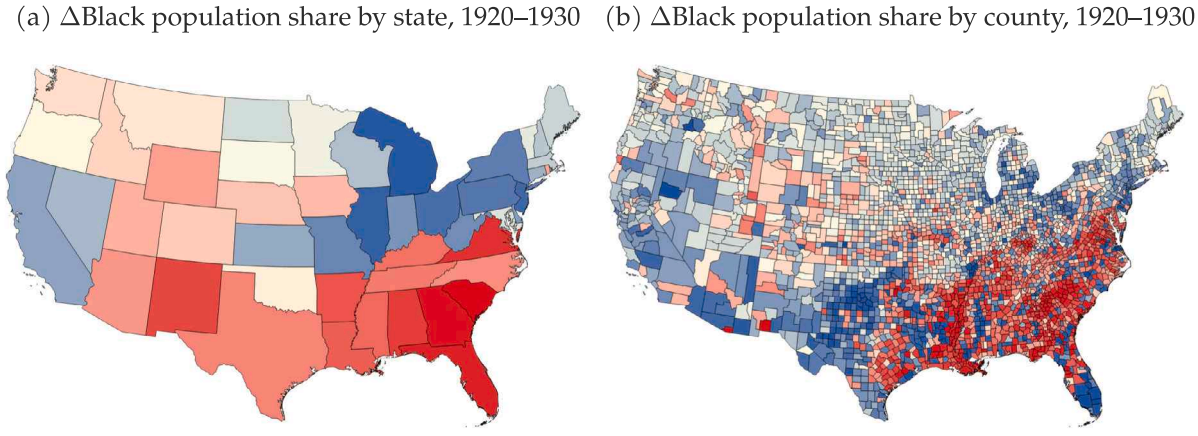


Fig. B.1. The Great Black Migration.
Note: Subfigures a and b plot the changes in the black population share between 1920 and 1930 in each state and in each county, respectively. Darker shades of red represent a greater decline in black population share, and darker shades of blue represent a greater increase in black population share. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

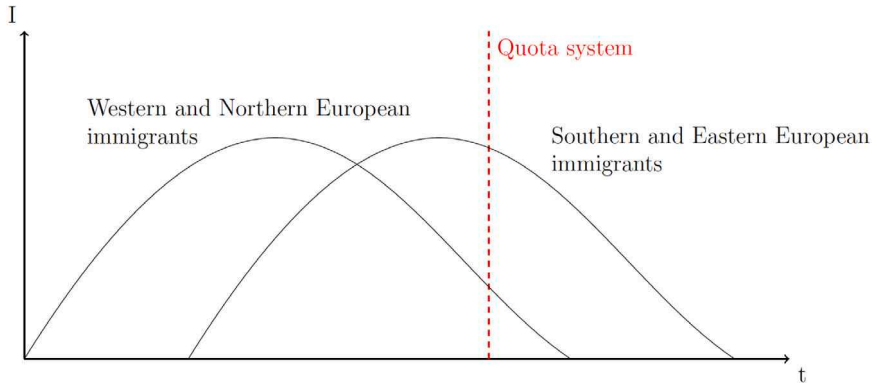


Fig. B.2. Emigration life cycles and the immigration quota system.
Note: This figure illustrates the stylized emigration life cycles of Western and Northern European immigrants and Southern and Eastern European immigrants. The quota system was implemented when the former was in decline and the latter was still at its peak.

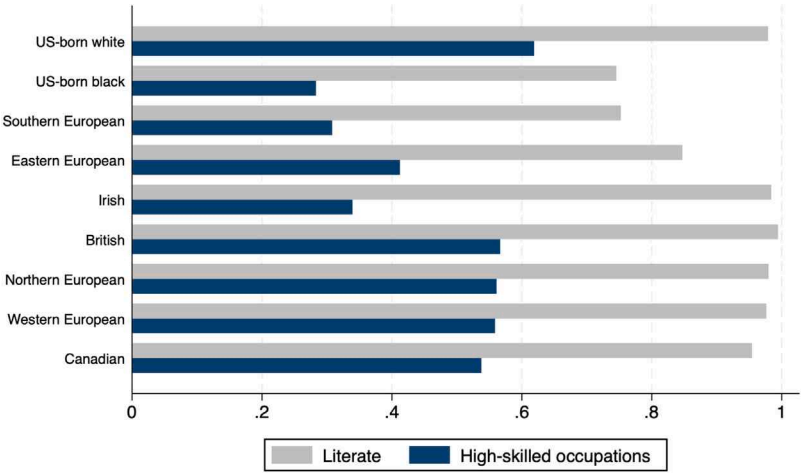


Fig. B.3. Literacy rate and high-skilled occupation share by race and origin in 1920.
Note: This figure shows the average literacy rate and high-skilled occupation share of each racial or immigrant group in the 1920 census.

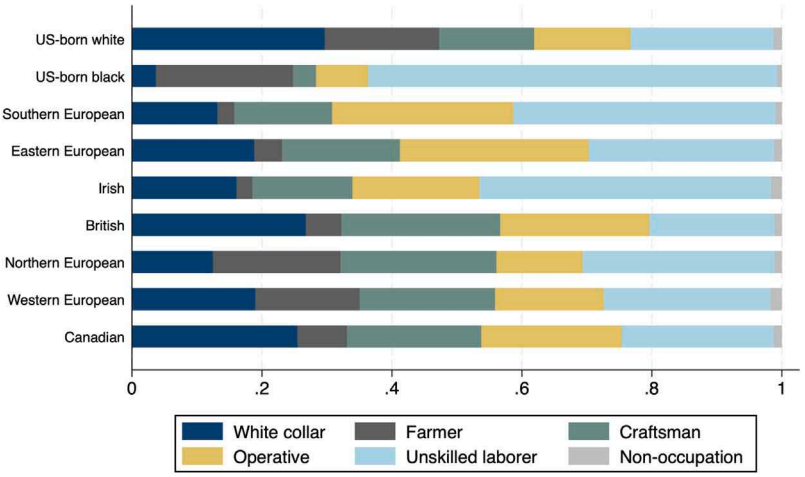


Fig. B.4. Occupational distribution by race and origin in 1920.
Note: This figure shows the occupational distribution of each racial or immigrant group in the 1920 census.

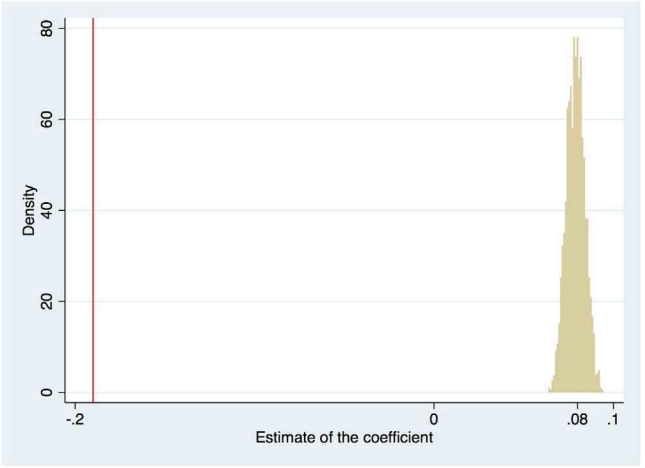


Fig. B.5. Placebo test for first-stage spurious correlation.
Note: This figure plots the histogram of the estimated coefficients by regressing the change in the share of immigrants between 1920 and 1930 on 2000 placebo instruments. The estimated coefficient by regressing the change in the share of immigrants on the true instrument is plotted as the red line. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table B.1
Pre-quota annual inflow and quota by country.

	Average annual inflow	Annual quota		Quota-to-inflow ratio	
	1900–1914	1921	1924	(2)/(1)	(3)/(1)
	(1)	(2)	(3)	(4)	(5)
Eastern Europe					
Austria–Hungary	154,964	27,446	4961	17.7%	3.2%
Poland	175,723	25,827	5982	14.7%	3.4%
Romania	4678	7419	603	158.6%	12.9%
Russia	52,579	39,794	2843	75.7%	5.4%
Turkey	22,734	7672	971	33.7%	4.3%
Southern Europe					
Greece	8507	3294	100	38.7%	1.2%
Italy	202,353	42,057	3825	20.8%	1.9%
Portugal	7804	2520	503	32.3%	6.4%
Spain	3563	912	131	25.6%	3.7%
Western Europe					
Belgium	4724	1563	512	33.1%	10.8%
France	7449	5729	3954	76.9%	53.1%
Germany	28,980	67,699	51,327	233.6%	177.1%
Netherlands	5214	3607	1648	69.2%	31.6%
Switzerland	3423	3752	2081	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–Norway	22,287	17,821	9242	80.0%	41.5%
Sweden	22,244	20,042	9561	90.1%	43.0%

Note: This table reports the average annual immigrant inflows between 1900 and 1914 from each European country (column 1), the annual quotas allotted to each European country under the Emergency Quota Act of 1921 and the Immigration Act of 1924 (columns 2 and 3), and the quota-to-inflow ratios (columns 4 and 5).
Sources: *Annual Report of the Commissioner-General of Immigration to the Secretary of Labor* (1924); *International Migrations, Volume I: Statistics* (1929).

Table B.2
The effect of immigration shock on occupational distribution.

Dependent variable	ΔPopulation share in the occupational category, 1920–1930					
Occupational category	White collar (1)	Farmer (2)	Craftsman (3)	Operative (4)	Unskilled laborer (5)	Non-occupation (6)
Panel A. US-born whites						
ΔImmigrant-to-native ratio	0.166***	−0.193***	0.021	−0.001	−0.003	0.010
	(0.025)	(0.035)	(0.026)	(0.035)	(0.028)	(0.016)
Observations	2537	2537	2537	2537	2537	2537
Panel B: All immigrants						
ΔImmigrant-to-native ratio	0.101***	−0.107**	0.005	0.090**	−0.117**	−0.005
	(0.028)	(0.050)	(0.025)	(0.038)	(0.058)	(0.012)
Observations	2503	2503	2503	2503	2503	2503
Panel C. US-born blacks						
ΔImmigrant-to-native ratio	−0.123**	0.013	−0.018	−0.316	0.392*	0.052
	(0.053)	(0.038)	(0.024)	(0.192)	(0.200)	(0.038)
Observations	2241	2241	2241	2241	2241	2241

Note: This table reports the 2SLS estimates from the regression specification of Eq. (5) using the sample of all counties. The dependent variable is the difference in the population share in the corresponding occupational category between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table B.3
The effect on individual occupational income score by origin and literacy.

Dependent variable	ΔLn(individual occupational income score), 1920–1930							
	SSE immigrants		Other immigrants		Literate workers		Illiterate workers	
	Non-movers (1)	In-migrants (2)	Non-movers (3)	In-migrants (4)	Non-movers (5)	In-migrants (6)	Non-movers (7)	In-migrants (8)
ΔImmigrant-to-native ratio	0.057	−0.163	0.173***	−0.336	0.125***	−0.569***	−0.418	−0.923***
	(0.082)	(0.161)	(0.060)	(0.246)	(0.026)	(0.109)	(0.263)	(0.240)
R^2	0.001	0.025	0.000	0.018	0.000	0.031	0.002	0.030
Observations	175 441	154 436	262 480	160 209	3 819 746	2 413 854	88304	106 219

Note: This table reports the 2SLS estimates from the individual-level first-difference regressions of Eq. (6). The dependent variable is the difference in the natural logarithm of individual occupational income score between 1920 and 1930. "SSE immigrants" indicates Southern and Eastern European immigrants. "Other immigrants" include immigrants from Britain, Northern Europe, Western Europe, and Canada. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the county level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table B.4
The effect of immigration shock on individual occupational choice.

Dependent variable	ΔIndividual occupational choice, 1920–1930					
Occupational category	White collar (1)	Farmer (2)	Craftsman (3)	Operative (4)	Unskilled laborer (5)	Non-occupation (6)
Panel A. US-born whites - Non-movers						
ΔImmigrant-to-native ratio	0.076**	−0.343***	0.127***	0.037*	0.055	0.048
	(0.036)	(0.056)	(0.032)	(0.021)	(0.051)	(0.109)
Observations	3 683 386	3 683 386	3 683 386	3 683 386	3 683 386	3683386
Panel B. US-born whites - In-migrants						
ΔImmigrant-to-native ratio	−0.406***	0.047	0.017	−0.183***	0.355***	0.171*
	(0.069)	(0.030)	(0.025)	(0.068)	(0.098)	(0.089)
Observations	2 277 848	2 277 848	2 277 848	2 277 848	2 277 848	2277848
Panel C. Immigrants - Non-movers						
ΔImmigrant-to-native ratio	0.034	−0.087**	0.099***	0.130	0.078	−0.255*
	(0.036)	(0.039)	(0.038)	(0.082)	(0.070)	(0.144)
Observations	510 490	510 490	510 490	510 490	510 490	510 490

(*continued on next page*)

Table B.4 (*continued*).

Panel D. Immigrants - In-migrants						
ΔImmigrant-to-native ratio	−0.026	0.148***	−0.047	−0.312*	0.070	0.168*
	(0.039)	(0.052)	(0.053)	(0.182)	(0.179)	(0.088)
Observations	395 576	395 576	395 576	395 576	395 576	395 576
Panel E. US-born blacks - Non-movers						
ΔImmigrant-to-native ratio	−0.094***	−0.326**	0.034	0.008	0.517*	−0.139
	(0.036)	(0.136)	(0.058)	(0.091)	(0.274)	(0.183)
Observations	143 695	143 695	143 695	143 695	143 695	143 695
Panel F. US-born blacks - In-migrants						
ΔImmigrant-to-native ratio	−0.067	0.947***	−0.006	−0.365**	−1.222***	0.713***
	(0.063)	(0.253)	(0.064)	(0.152)	(0.394)	(0.263)
Observations	240 470	240 470	240 470	240 470	240 470	240 470

Note: This table reports the 2SLS estimates from the individual-level first-difference regressions of Eq. (5). The dependent variable is the difference in individual occupational choice in the corresponding occupational category between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the county level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table B.5
The effect on non-movers in the south and south-to-north white migrants.

Dependent variable	ΔLn(individual occupational income score)	
Sample	Black non-movers in the South	South-to-North white migrants
	(1)	(2)
ΔImmigrant-to-native ratio	0.929	−0.970***
	(0.694)	(0.239)
First-stage F-statistics	6.9	109.0
Observations	92698	125 492

Note: This table reports the 2SLS estimates from the individual-level first-difference regressions of Eq. (5). The dependent variable is the difference in the natural logarithm of individual occupational income score between 1920 and 1930. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the county level are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Table B.6
Summary statistics of black in-migrants and non-movers in the north.

Sample	Black in-migrants in the North		Black non-movers in the North	
	1920	1930	1920	1930
Literacy rate	0.864	0.954	0.952	0.950
Urban	0.527	0.787	0.774	0.784
Agricultural sector	0.307	0.098	0.149	0.124
Manufacturing sector	0.255	0.310	0.327	0.247
High-skilled occupation	0.249	0.306	0.211	0.262
Low-skilled occupation	0.669	0.652	0.739	0.707
Occupational categories				
White collar	0.047	0.139	0.086	0.122
Farmer	0.138	0.045	0.042	0.046
Craftsman	0.064	0.121	0.082	0.094
Operative	0.115	0.140	0.152	0.149
Unskilled laborer	0.554	0.512	0.587	0.558
Non-occupation	0.082	0.043	0.051	0.031

Note: This table reports the average characteristics of black in-migrants and non-movers in northern counties in 1920 and 1930.

Table B.7
2SLS estimates using alternative instruments.

Projection	Cubic	Fractional polynomial		10-yr MA	Fixed level
		2-dim.	3-dim		
	(1)	(2)	(3)	(4)	(5)
Panel A. Wage and occupational standing					
Dependent variable:					
ΔLn(average manufacturing wage)	0.187	0.137	0.285	0.089	0.153
	(0.208)	(0.190)	(0.242)	(0.198)	(0.192)
ΔLn(average occupational income score)					
US-born whites	0.179***	0.181***	0.159***	0.191***	0.182***
	(0.041)	(0.039)	(0.042)	(0.031)	(0.034)
Immigrants	0.213***	0.209***	0.218***	0.126***	0.171***
	(0.045)	(0.044)	(0.048)	(0.041)	(0.040)
US-born blacks	−0.043	−0.043	0.043	−0.202*	−0.122
	(0.065)	(0.070)	(0.101)	(0.112)	(0.084)
Panel B. Internal migration					
Dependent variable:					
Ln(# of total internal migrants)	−8.075***	−8.617***	−6.695**	−8.263***	−8.694***
	(3.484)	(3.697)	(3.589)	(3.399)	(3.384)
Ln(# of US-born white migrants)	−6.392**	−6.994***	−5.179*	−6.781***	−7.079***
	(2.455)	(2.291)	(2.629)	(2.022)	(2.154)
Ln(# of foreign-born migrants)	−15.914***	−16.006***	−13.726***	−15.742***	−16.179***
	(2.511)	(2.531)	(2.222)	(2.483)	(2.408)
Ln(# of US-born black migrants)	−12.019***	−12.749***	−10.219**	−12.140***	−12.892***
	(3.728)	(3.479)	(4.104)	(3.657)	(3.496)
ΔLn(individual occupational income score)					
US-born whites - Non-movers	0.085**	0.099***	0.099***	0.096***	0.106***
	(0.034)	(0.036)	(0.033)	(0.030)	(0.033)
US-born whites - In-migrants	−0.683***	−0.708***	−0.528***	−0.771***	−0.726***
	(0.118)	(0.118)	(0.115)	(0.100)	(0.104)
Immigrants - Non-movers	0.094	0.095	0.130	0.053	0.074
	(0.073)	(0.068)	(0.082)	(0.050)	(0.061)
Immigrants - In-migrants	−0.261	−0.274	−0.106	−0.428**	−0.338*
	(0.200)	(0.196)	(0.189)	(0.204)	(0.196)
US-born blacks - Non-movers	−0.043	−0.034	−0.015	−0.208	−0.111
	(0.212)	(0.211)	(0.195)	(0.172)	(0.207)
US-born blacks - In-migrants	−0.653	−0.593	−0.783*	−0.576	−0.384
	(0.450)	(0.447)	(0.437)	(0.351)	(0.454)
Panel C. The Great Black Migration (Northern counties)					
Dependent variable:					
ΔBlack population share	−0.082***	−0.087***	−0.081***	−0.082***	−0.088***
	(0.025)	(0.023)	(0.024)	(0.026)	(0.022)
ΔShare of blacks born in a diff. state	−0.072***	−0.077***	−0.069***	−0.073***	−0.079***
	(0.024)	(0.023)	(0.024)	(0.026)	(0.022)
ΔShare of blacks born in the South	−0.050***	−0.055***	−0.046**	−0.057***	−0.058***
	(0.018)	(0.018)	(0.018)	(0.021)	(0.017)
Ln(# of black migrants)	−9.532***	−10.794***	−7.099**	−11.512***	−11.370***
	(3.083)	(2.940)	(3.391)	(2.492)	(2.630)
Ln(# of South-to-North black migrants)	−8.346***	−9.515***	−6.344*	−9.863***	−9.699***
	(2.883)	(2.769)	(3.161)	(2.152)	(2.356)
Ln(# of within-North black migrants)	−11.534***	−12.628***	−8.991***	−13.957***	−13.509***
	(2.951)	(2.824)	(3.168)	(2.489)	(2.610)
ΔLn(individual occupational income score)					
All US-born blacks	−0.823***	−0.792***	−0.704***	−0.847***	−0.816***
	(0.180)	(0.178)	(0.178)	(0.161)	(0.159)
US-born blacks - Non-movers	−0.218	−0.209	−0.140	−0.333**	−0.247
	(0.171)	(0.170)	(0.156)	(0.163)	(0.164)
US-born blacks - In-migrants	−1.114***	−1.068***	−0.954***	−1.081***	−1.077***
	(0.247)	(0.241)	(0.248)	(0.224)	(0.218)
South-to-North black migrants	−0.731**	−0.682**	−0.635**	−0.666**	−0.651**
	(0.299)	(0.289)	(0.310)	(0.257)	(0.266)
Within-North black migrants	−1.181***	−1.134***	−1.025***	−1.198***	−1.169***
	(0.283)	(0.274)	(0.279)	(0.243)	(0.250)

(*continued on next page*)

Table B.7 (*continued*).

Projection	Cubic	Fractional polynomial		10-yr MA	Fixed level
		2-dim.	3-dim		
	(1)	(2)	(3)	(4)	(5)
Panel D. Manufacturing production					
Dependent variable:					
ΔLn(wage workers per establishment)	1.668***	1.653***	1.428***	1.602***	1.655***
	(0.276)	(0.287)	(0.257)	(0.248)	(0.264)
ΔLn(horsepower per establishment)	1.116**	1.131**	0.813	1.838***	1.501***
	(0.492)	(0.488)	(0.603)	(0.337)	(0.391)
ΔLn(horsepower per wage worker)	−0.553	−0.522	−0.615	0.235	−0.154
	(0.417)	(0.425)	(0.482)	(0.216)	(0.303)
ΔLn(value added per establishment)	2.021***	1.942***	1.901***	1.947***	2.029***
	(0.490)	(0.442)	(0.507)	(0.467)	(0.500)
ΔLn(value added per wage worker)	0.353	0.288	0.473	0.345	0.373
	(0.347)	(0.307)	(0.373)	(0.313)	(0.333)
ΔLn(number of establishments)	−0.825**	−0.916***	−0.663**	−1.188***	−1.038***
	(0.309)	(0.287)	(0.322)	(0.259)	(0.275)

Note: This table reports the 2SLS estimates of the coefficients on Δimmigrant-to-native ratio from the county-level first-difference regressions of Eq. (5) and the individual-level first-difference regressions of Eq. (6) with the indicated outcome (in the left column), using instruments constructed from alternative projection methods. The instrument in column 1 is constructed using the predictions from cubic curve-fitting. The instruments in columns 2 and 3 are constructed using fractional polynomial curve-fitting with 2 and 3 dimensions, respectively. The instrument in column 4 is constructed using 10-year moving average. The instrument in column 5 is constructed with a constant predicted inflow same as the inflow in 1921 for each country. All regressions control for the changes in age composition, literacy rate, and female population share between 1920 and 1930, the industrial employment composition in the manufacturing sector in 1920, the changes in manufacturing employment share and average wage between 1900 and 1920, and state-specific time trends. Standard errors clustered at the state level (in county-level regressions) and at the county level (in individual-level regressions) are reported in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

Appendix C. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jce.2024.12.004.

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