Appendix for:

Does It Matter Where You Came From? Ancestry Composition and Economic Performance of US Counties, 1850–2010

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Appendix A: Constructing the Ancestry Vector

Appendix B: Constructing County GDP

Appendix C: Creating a density of arrival times

Appendix D: Constructing country of origin measures

Appendix E: Sorting, endogeneity and instrumental variables estimates

Appendix F: Creating an index of occupational variety

References

Additional Tables and Figures

A Constructing the ancestry shares

In this section, we describe our construction of the ancestry shares. Since each county is composed of many ancestries, we record the information on all of the shares in a single ancestry vector (AV) which describes the full distribution of ancestries in each county.

A.1 The Ancestry Vector for those who are not African American or indigenous

Approach for 1790–1840 when information is limited. The first census in 1790 collected some information by state on "nationality" but none of the censuses until 1850 collected such information. We use the 1790 census to create the initial state level nationality vector. The census did not collect nationality information again until 1850, so for the initial step we simply allocate the AV for each year between 1800 and 1820 based on the nationality in 1790. One nationality in 1790 is "Hebrew" although it is very small in all cases. We combine Hebrew with German.

From 1820 to 1830 and 1830 to 1840 the government started collecting information on immigrants, their country of origin and the state where they moved (Barde, Carter, and Sutch, 2006). We use these values to update the 1790 ancestry vector to account for the immigration flows during these two decades.

Approach for 1850, 1860, 1870, 1980, 1990, and 2000 when no parent data exists, but we have individual data on nativity. Starting in 1850 the census asked the country of birth for those born outside the United States and the state of birth for those born within. Samples from the records have been collected and digitized and are stored in the Integrated Public Use Microdata Series (IPUMS) collected by Ruggles et al. (2010). For most years the sample was 1 in 100 but larger samples (5%) exist for some years and we use those where possible. We further utilized the full census results when available.

For each person in the microsample, we create an ancestry vector. The person receives a one for the place of birth if he or she is from that foreign country. Starting in 1880 the census also recorded the place of an individuals' parents. We describe how we use this information below. Without the parent information, for non-immigrants we attribute to an individual the AV for the group of respondents who have children five years or younger in the place of birth at the time of her birth. In other words, we attribute to a person the AV of the group who are most likely to be her parents. For a non-immigrant who lives in the same state as she was born, we attribute to her the AV for the parent group in the county where she lives now as of the closest census to her birth. We give non-immigrants who have moved the AV for the parent group from their state of birth as of the closest census to their birth. The AV for the parent group reflects differences of the fertility rate across families with different origin. We incorporate these differences by weighing the AVs of parents by the number of children five-or-younger that they have. This means that the AV of the parent group in a county where parents of Irish origin, for example, produce disproportionately more children will properly capture the higher likelihood that the children from this county are also of Irish descent.

During a period of rapid immigration keeping track of the changing demographics matters. For example, consider someone who was 40 years old in the 1870 census and was born in Suffolk county, Massachusetts which contains Boston. We would not want to give a large probability that she had an Irish ancestry, since there was not yet a large Irish presence in 1830. On the other hand, a 10 year old in 1870 would be much more likely to have an Irish ancestry The combination of more Irish, more Irish in the parent group, and more Irish children if Irish parents have larger families makes Irish ancestry more likely. We create the county average over all individuals to give AV for county and state in that year, as well as the AV for those respondents with children fiver years or younger (the "parent" AV). Since we have only state level variation until 1850, 1860 is the first year where the parent AV will differ by county. In later years as we move forward with additional microdata, counties become increasingly diverse. First generation migrants still alive in 1850 are captured exactly, however, and so our approach correctly accounts for immigrants from well before 1850.

Approach for 1880 to 1970 using parent nativity. From 1880 to 1970 the census also collected information on the birthplace of the parents of each person in the census. We use the same procedure when only the individual birth place is known for the parents, and then give the individual one half of each parent's AV, so $AV_i = 0.5AV(Mother_i) + 0.5AV(Father_i)$. For the foreign born parents we assign them an AV with 1 for the country of birth and zero elsewhere. For native parents, we assign the parent the AV for the parent group in each parent's state of birth in the closest census of birth. If the parent is born in the same state the individual is living in now, we assign the parents the county AV for the parent group in the birth year. It is common for both parents to be from the same country, in which case the AV is just 1 in the country of origin of both parents.

Approach for 1890 when no individual data exists. Because a fire wiped out all of the individual level 1890 records, we have to use aggregate data published by the census for this year. The NHGIS (Minnesota Population Center, 2011) has collected county level information for a wide range of variables in a number of census years, including 1890, from the published census volumes. These record the place of birth of the foreign born population. For each county the AV is: $AV(\text{County}) = (\text{Fraction Foreign}) * AV(\text{Foreign Born}) + (\text{Fraction Native}) * AV(\text{Natives})$.

Forming the non-immigrant AV is more difficult, since the place of birth is only available at the state level. We use the demographic structure by state in 1880 aged by 10 years to assign weights for birth years—the fraction of the native population born closest to the 1880 census, the 1870 census and so on. Then we assign the native AV over all states as the double sum over state s birthplace (BPL) and year of birth for each age group d:

$$AV(\text{Native born in state}_j) = \sum_{s=1}^{S} \sum_{d=0}^{D} f_{s,j} f_{d,j} AV(s, \text{birthyear of } d)$$

where $f_{s,j}$ is the fraction of the native population in state j born in state s and $f_{d,j}$ is the fraction of birth group d in state j as constructed from 1880.

Approach for 1940. The 1940 census introduced for what appears to be the first time supplemental questions that were asked to only a subset of the population. We use the question about ancestry in the supplement. The Public Use Microdata Sample then took a sample from the people who answered the supplemental question and their households. Since that would tend to over-sample large households, they first sampled people who had been selected to answer the supplemental question, and then selected the households of that person with probability equal to the inverse of household size. It is an elegant solution since it gave a representative sample of the entire population and ensured that every household had one person who had answered the supplemental questions. The procedure means that selecting only those who have answered the supplemental questions is no longer representative. We use the sample weights to adjust for the sampling procedure.

A.2 African Americans and indigenous peoples

Race is a very important and sensitive issue in the US. Since we are primarily interested in the relationship that culture and institutions have with economic outcomes, forced migration and slavery are one potential source of a particular set of culture and institutions. We therefore treat self-identified "black" and "white" as non-mixing groups which contains separate ancestries within them. Within "blacks" we then distinguish between the descendants of ancestors who were brought from Africa as slaves—whom we refer to as African American—and later African migrants from countries such as Nigeria or "black" migrants from the Caribbean. African Americans represent by far the largest group, although some counties have significant concentrations from various African countries.

Treating the combined African ancestries as a separate non-mixing group ignores many complexities of race in America, but we think it is closer to capturing the experience of race in US history. In the long and racist history of the United States, the societal rules have tended to make "black" an absorbing state and actively worked to prevent intermarriage. The rape of slave women was widespread (Kolchin, 2003, pp. 124-5), and so many African Americans are the partially descendants of slave holders. Yet children of "black" mothers were still considered "black" and were still slaves (Higginbothham and Kopytoff, 2000). After the Civil War, interracial marriage was still illegal in 17 states in 1967 when the US Supreme Court struck down anti-miscegenation laws (Kennedy, 2000, p. 62). Such laws had the unseemly consequence that made it legally necessary to define who was prohibited from marrying whom by virtue of their "blood" (Saks, 2000). The strictest rule held that "one drop" of blood of African ancestry made someone "black," although the enforcement was not universal and less strict rules also existed (Kennedy, 2000). Partly as a consequence of this history, intermarriage between "blacks" and "whites" were uncommon until very recently. Intermarriage among all races represented just 3.2% of marriages in 1980 and 8.4% in 2010 (Wang, 2012). Further, intermarriage is not necessarily a problem in constructing aggregate county ancestry if the children of mixed race couples do not systematically report themselves as one race or the other.

Similar to African Americans, we treat Native Americans as their own ancestry group. Partly due to the legacy of forced settlement into reservations, some counties have a large presence of Native Americans. They are not always recorded well in the early censuses. Where possible, we take self-identified natives as their own ancestry group and assume no mixing. Except for counties with reservations, they are typically a small portion of the population, so this assumption is not important for our results.

A.3 On mixing

Our procedure does not distinguish between complete ancestry mixing and the full separation of ancestries that share the same geography. For example, in a population half German and half Irish, the second generation will have an AV half German and half Irish whether or not all of the Germans marry Germans and all of the Irish marry Irish or there is inter-marriage between Irish and Germans. The AV is thus the appropriate estimate of the expected ancestry of any individual from that population, but does not provide a measure of cultural mixing, only of co-location. For African Americans the use of race assumes that they are fully African American.

A.4 Aggregation and PUMAs

To protect anonymity, from 1950 onwards the microdata does not typically give counties for the individual records. Usually there is some geographic identifier that combines several counties, although in 1960 only state level information is available. We therefore use the somewhat larger units available in each year to update the county level, but maintain the county as the basic unit of observation. The basic idea is that counties within a group will have a different history and different AV from when we can fully identify them from 1940 and earlier. The new information from each post-1940 census is the same within each group but is applied to an already existing AV. Finally, we aggregate the constructed county level data up to the 1980 Public Use Micro Areas (PUMAs) since these are the most consistently used areas after 1950. In keeping with the terminology starting in 1950, we refer to these somewhat larger aggregates as county groups.[1]

A.5 Comparison to recent measures of ethnicity

In this section, we examine how our measure of ancestry compares to self-reported ethnicity and ancestry in the US census in 2000. Ancestry is not the same as ethnicity, although the two are clearly linked. Instead, we view ancestry as one of the inputs used to construct ethnicity. Indeed, in the United States, it appears to be the primary input (Waters, 1990). There is substantial evidence that self-reported ethnicity is selective (Duncan and Trejo, 2011) changing by generation and through circumstances. We document one important form of selection below: The tendency for those of English ancestry to create new identities, such as "American," for themselves rather than self-identifying with their ancestry. Nonetheless, our measure of ancestry and self-reported

[1]See `https://usa.ipums.org/usa/volii/tgeotools.shtml` for a description of the geographic identifiers used over time.

ancestry and ethnicity are strongly correlated.

Reflecting the changing views about ethnicity and ancestry, the questions asked in the census have changed somewhat since they were first introduced in 1980. We focus on the 2000 census because it is the most recent one for which the full micro data are available, but all of our qualitative results are the same for the other censuses. In the 2000 census, the question read "What is this person's ancestry or ethnic origin?" and two responses were possible. In the comparisons below, we aggregate at the county group level using the first ancestry reported and create a measure of the fraction of each self-reported ethnicity in a county.

One difficulty with the comparison is that what people self-report reflects their beliefs about themselves, not necessarily their objective ancestry as we measure it. English ethnicity is the most complicated since there is no longer much self-identification of English ethnicity. In the 2000 census, only 5.9% self-report an English ethnicity, while 7.2% give their ethnicity as "American," 19.1% do not report, and 1.4% report "White/Caucasian." "Texas" and "Southerner" were also valid responses and chosen in some census years. We include all of the variations of "American" together with English, Welsh, and Scottish in the English ancestry.

We examine how well the aggregate shares of the first self-report ancestry from the Census and our measure compare in Figure A-1. They are typically very close, lying very close the 45 degree line for most ancestries. For some very small ancestries in the upper left, there are larger differences. These ancestries are composed variations of "Southern Europe, Not Specified" or "Baltic States, Not Specified." While these birthplaces have generally been valid responses, because we built up our ancestry measure from the actual birthplace of a migrant or her parents, we are far more likely to classify someone to a particular country, so put a smaller share in these generic ancestries.

Our measure of ancestry is highly correlated geographically with self-reported ethnicity or ancestry in the 2000 census. We summarize these geographical-ancestry correlations in Table A-1. Across all county groups and ancestries the correlation between ancestry and self-reported ethnicity is 0.966. We also report the correlation between ancestry and self-reported ancestry across county groups for the largest ancestries. They are all highly correlated: 0.92 for Germans, 0.988 for African Americans, 0.86 for Irish, 0.94 for Italians. The correlation is also good for smaller groups from diverse continents: 0.99 for the Philippines, 0.99 for China, 0.98 for Jamaica, and 0.805 for Nigeria.

When we include those who report themselves to be "American" with the English ancestries, the correlation is 0.93 between English ancestry and the combined English self-reported ethnicity. The geographic correlation is only 0.36 when we do not include the self-reported "American" ancestries. One interpretation of this evidence, consistent with the constructivist approach to ethnicity, is that the dominant ethnicity is English and so all other ethnicities are defined as different from English. Then many whose ancestry is English do not think of themselves as having an ethnicity since they have the dominant ethnicity.

B Constructing county GDP

B.1 County manufacturing and agricultural value added 1850-1940

Minnesota Population Center (2011) collects census tables for many decades recording for each county the total value of agricultural output and the value of manufacturing output and costs of inputs. We construct nominal value added of manufacturing by subtracting the cost of inputs from the total output. In 1850, the census did not collect manufacturing inputs. We use the average of the 1860 and 1870 county level ratio of outputs to inputs in manufacturing to create inputs for 1850, 1860 and 1870.

For agriculture during this period the only local measures that exist are of output, not value added. No good measure at the county level exists of the costs of inputs in agriculture over a long period. Agriculture does have intermediate inputs such as fertilizers as well as agriculture inputs used in the production of other agricultural outputs such a feed corn for cattle and seed. To account for these inputs, we construct a national measure of the ratio of value added to total output by subtracting intermediate inputs from total agricultural output using series K 220 -250 from United States Census Bureau (1975). While intermediate inputs were small early on at about 6% in 1850, increasing to nearly 12% by 1900, by 1940 they were nearly 40%. Adjusting for intermediate inputs hastens the relative decline of agriculture after 1900. We apply the ratio between nominal value added and output at the national level to the value of county level agricultural output to obtain an estimate of agricultural value added at the county level.

The census did not collect manufacturing data in 1910, although estimates of it exist at a national level. To create county level manufacturing, we interpolate between 1900 and 1920 using the national growth in manufacturing value added and allocating growth to each decade in the same way we allocated growth in services so that manufacturing value added grows in each decade in each county at the same rate it does at the national level.

B.2 Constructing value added in services, mining and construction for the period 1850-1940

The micro-samples of the decadal census collect information on the occupation of the individuals. We allocate the occupations to correspond to the following broad NIPA categories: trade, transportation and public utilities, finance, professional services, personal services, government, mining and construction. We then identify the workers employed in each of these industries in each county according to the occupation listed by the respondents to the census. We also collect estimates of nominal value added per worker in each industry at the national level. When we have information on both employment and wages (earnings) at the county level so that we can construct the sectoral wage bill for each county, we distribute national GDP in an industry according to the wage bill of each county relative to the national wage bill in that industry. In section B.2.1, we discuss under which conditions this is exactly the right thing to do and provide an intuitive interpretation for our procedure. To obtain local GDP per worker, we divide by employment in each sector at the county level.

We have all the relevant information for the full 1940 census and we use the same allocation for the adjacent decades of 1950 (where there is much sparser wage information) and 1930. For the earlier decades, for which we have some information on wages within each sector only at the state level (or for the major city within a state), we combine this historical information with the detailed wage distribution available for the full sample in 1940 to obtain a wage distribution that is specific to a given state and allows for difference between urban and rural areas that replicate their ratio in 1940. See Section B.2.2 for details and sources. In the former case, we allow nominal GDP per worker to differ by county. In the latter case, we allow nominal GDP per worker to be state specific (according to the historical wage information) and to vary between urban and rural counties the way it did in 1940.

Allocating occupations to industrial sectors involves difficulties and judgment calls. For instance, some occupations such as legal services that we classify as a professional service for an individual, may be part of manufacturing value added when performed for a manufacturing firm. We use the 1950 occupations definitions from IPUMS and their corresponding industries using their 1950 definitions of industries. We make some slight changes to the codes to follow the divisions used in the early national accounting measurements.

In addition, the sexism and racism inherent in the early censuses poses additional difficulties. In 1850 women were not coded as having an occupation. While many women did work solely in domestic production, some women were employed outside the home. Similarly, in 1850 and 1860, slaves were not listed as having an occupation. While both slaves and women were enumerated for political purposes, we do not have information on their occupation. Many, but not all, of the slaves would have been employed in agricultural production, either directly or indirectly so we are not missing their output entirely, only undervaluing the skilled services they did provide. Finally, since the physical census records from 1890 were largely destroyed by fire, there is no micro-sample from 1890. We linearly interpolate for each county the employment by industry category in 1890 using 1880 and 1900, but otherwise calculate county value added per worker in the same way.

B.2.1 Using wages to infer relative productivity

Assuming that factors are paid their marginal product, wages are informative about relative productivity. This is the basic reason to use the relative wage bill in allocating national value added in a sector to an area. More specifically, under perfect competition and a constant returns to scale Cobb Douglas production function (with the same factor elasticities but different levels of productivity across counties) the share of nominal value added of a county out of national value added equals the county wage bill relative to the national wage bill.

More precisely, if the United States is divided into C counties with nominal GDP in a particular industry and year equal to Y_c^N (where we do not show the industry and year subscripts) so that U.S.

GDP in an industry is:

$$Y_{US}^N = \sum_{c=1}^{C} Y_c^N.$$

Production takes the simple Cobb-Douglas form within each county:

$$Y_c = A_c K_c^{\alpha} L_c^{1-\alpha}.$$

where Y_c denotes real GDP, A_c productivity, K_c capital, and L_c labor. Under perfect competition in the output market, if labor is paid its marginal revenue product, the wage is proportional to the GDP per worker in c:

$$w_c = MRPL_c = P(1-\alpha)A_c K_c^{\alpha} L_c^{-\alpha} = P(1-\alpha)Y_c/L_c,$$

where P denotes the common output price. Then it is easy to show that (by multiplying through by L_c, and dividing the resulting equation by its summation over counties):

$$Y_c^N = PY_c = \frac{w_c L_c}{\sum_c w_c L_c} Y_{US}^N. \tag{1}$$

Another way to rewrite equation (1) is:

$$\frac{Y_c^N}{L_c} = \frac{w_c}{\sum_c w_c (L_c/L_{US})} \frac{Y_{US}^N}{L_{US}}. \tag{2}$$

so we can recover nominal GDP per worker in each industry and county c using national GDP per worker and the relative wage. This procedure allows the productivity of a worker in each sector (as proxied by the wage) to vary by location.[2] Note that we make no assumptions about the equalization of marginal products across regions or about migration. Note also that the result above

[2]We use equation (2) to calculate county GDP rather than (1) because national value added includes some areas that are not covered well by the census micro-samples. These areas include Hawaii, Alaska, and Puerto Rico for which the census has incomplete coverage, and US overseas possessions.

holds even if the output market is monopolistically competitive, provided the markup is common across the US.

When wage data is not available at the county level, but at the state level, we follow the same approach. When we do not have complete wage information, we assume that we can observe a wage $\tilde{w}_c = \theta w_c$ which is proportional to the average wage in the industry across all states.

Finally, for Finance, Insurance, and Real Estate, wages or income that is comparable across states is not available. Instead, we use the amount of banking capital in a state to infer productivity differences in FIRE. The basic idea is nearly identical to the approach used above for wages, except that we observe something proportional to total capital rather than a price. To the approach for wages we add the assumption that capital is mobile and so the user cost of capital, uc, is equalized across all counties. We also observe capital that is some constant share of the total capital in a state: $\tilde{K}_s = \theta K_s$. Then if capital is paid its marginal revenue product:

$$MRPK_s = P(1-\alpha)A_s K_s^{\alpha} L_s^{-\alpha} = P\alpha Y_s / K_s = uc$$

and so $Y_s = \frac{uc}{\alpha}\theta \tilde{K}_s$. Then in each state the value added for FIRE is obtained as:

$$Y_s^N = \frac{\tilde{K}_s}{\sum_j \tilde{K}_j} Y_{US}^N$$

which allows us to calculate value added per worker in FIRE in each state by dividing by labor and using the relative capital output ratio:

$$\frac{Y_s^N}{L_s} = \frac{\tilde{K}_s / L_s}{\sum_j \frac{\tilde{K}_j}{L_j} \frac{L_j}{L}} \frac{Y_{US}^N}{L_{US}}.$$

B.2.2 More on the distribution of wages by period and industry and their sources

For most of the period we only observe wages at the state level, but we use the distribution of wage across counties in 1940 to allow counties within a state to differ. The 1940 census was the first to ask about income or wages and has a complete sample. We detail below the particular assumptions we make to obtain county level nominal GDP for each year and industry. When county level wage data is not available, for decades up to 1920, we use state level information for wages (or for the major city in a state). The sources we use typically do not have coverage for all states in all years. We use the average wage in the state's census division to fill in the wage for missing states in each year. There are nine census divisions which correspond to the broad economic and climatic zones of the United States. Moreover, the state wage for particular occupation can be either a (weighted) average across urban and non urban areas or represent an urban or rural wage. We use the state level information and the ratio between urban and rural wages in 1940 to construct estimates of the state-urban/rural specific wages in an industry in the decades up to 1920. Urban and rural wages are constructed as total wage compensation divided by total employment in urban and rural in each year. Urban and rural are defined using the 1950 allocation to metropolitan and non-metropolitan areas, the first year such an allocation is available.

1940. The 1940 census asks for wages or income and we use the same classification system for employment to find the average wage within each county and industry. We then apply formula (1) directly at the county level to find the value added in each county.

1950. The 1950 census has only a 1% sample, and asked questions about income and wages to only one in five respondents (not all of whom had any income). We therefore use the 1940 wage distribution at the county level for 1950 as well, but use the 1950 employment from the County Books described above which was originally calculated from the full census. See section B.4 for the calculation of employment.

1930. We apply the 1940 distribution of wages across counties and industries to the 1930 employment by county and industry.

Wages by state for Trade 1850-1920. We use the wage in each state for bakers (1880-1898 across states, 1907-1928 for select cities) and dress makers (1875- 1898 across states) from the United States Department of Labor (1934), page 148 and 219. Since the coverage is fragmentary for different states we take the average wage over several years to form the decade distribution across states. For bakers: 1880 is the average from 1880 to 1887; 1890 the average from 1886 to 1895; 1900 the average from 1891-1898; 1910 the average from 1907-1916; 1920 the average from 1917-1926 we assume the distribution for 1850, 1860, and 1870 follows 1880. For dressmakers: 1880 is the average from 1875 to 1886; 1890 the average from 1886 to 1895; 1900 the average from 1891-1898; we assume the distribution for 1850, 1860, and 1870 follows 1880; and the distribution in 1910 and 1920 follows 1900. Both wages are from urban areas. To form the wage for Trade we take the average of bakers and dress makers.

Wages by state for Transportation. We use the wage in each state for teamsters (male one horse teamsters from 1875-1900 across states, male two horse teamsters from 1913-1928 for select cities) and engineers (male in locomotive railroad from 1875-1898) from the United States Department of Labor (1934), starting on pages 449, 438 and 453. We convert both series into dollars per day, and we exclude the engineers in states which report only in per mile terms. Since the coverage is fragmentary for different states we take the average wage over several years to form the decade distribution across states. For both occupations we take averages over several years. For teamsters: 1870 is the average of 1875-1880; 1880 the average of 1876-1885; 1890 the average of 1886-1895; 1900 the average of 1891-1900; 1910 the average of 1913-1917; 1920 the average of 1916-1925; we assume the distribution for 1850 and 1860 follows 1870. For engineers: 1870 is the average of 1875-1880; 1880 the average of 1876-1885; 1890 the average of 1886-1895; 1900 the average of 1891-1900; we assume the distribution for 1850 and 1860 follows 1870; and the distribution in 1910 and 1920 follows 1900. We take both wages to be an average from urban and rural areas. To form the wage for Transportation we take the average of teamsters and engineers.

Wages by state for Education. We use the average monthly salaries of teachers in public schools as recorded in the Report of the Commissioner of Education for 1880 (Table 1, Part1, page 408), 1900 (volume 1, Tables 9-10, page 72), and 1915-16 (volume 2, Table 11, page 77). We use the average wage across all male and female teachers, and where the average is not reported for a state compute it as the weighted average of male and female teacher's salaries using the share of male and female teachers in the total. We assume 1850 through 1870 follow the 1880 distribution; 1890 follows the 1900 distribution; and 1910 and 1920 come from the salaries in 1915-1916. These are the average wages for the state.

Wages by state for Mining. We use the wage in each state for coal miners (male coal miners from 1875-1898) and iron miners (male, 1875-1899) from the United States Department of Labor (1934), page 330 and 333. In 1919 we use male hand miners of bituminous coal across states from the United States Bureau of Labor Statistics (1919), Table 3, page 9. Few wages exist early on, and so we use the average of 1880-1889 for the wage distribution in 1880, the average of 1880 to 1889 for 1890, and the average of 1890-1899 for 1900. We assume 1850 through 1870 follow the 1880 distribution; and 1910 and 1920 follows the 1919 distribution. The mining wage is the average of coal and iron mining wages in each year. Both mining wages are for rural areas.

Wages by state for Construction. We use the wages of bricklayers, carpenters, and masons from 1875 to 1928 first for states until 1900 and then select cities from the United States Department of Labor (1934), pages 155, 161, and 190. We assign the city wages to the state, and assume that all wages are urban wages. For each occupation we form 1870 using the average of 1875-1880; 1880 average of 1876-1885, 1890 average of 1886-1896; 1900 average from 1891-1900 since the series change in 1901; 1910 average from 1906-1915; and 1920 average 1916-1925. We take the average of the three occupations in each year to form a construction wage.

Wages by state for Government. The Annual Reports of the Postmaster General (1900) recorded the average compensation of fourth class postmasters by state. It is unclear from the text what frequency the salary is paid, but based on the maximum salary ($4000 to the postmaster general himself), the reported salaries appear to be quarterly. We were unable to find another report that gives a similar breakdown by state. We assume the distribution is the same as 1900 from 1850-1900. We also use the wages of male municipal laborers in sanitation and sewage from 1890-1903 from the Nineteenth Annual Report of the Commisisioner of Labor (1905), page 470. We form

1890 using the average of 1890-1895, and 1900 using the average of 1896-1903. We assume that 1850-1880 follows 1890. We form 1850 through 1890 by combining the wages of municipal laborers and postmasters Municipal wages are per hour, and so we combine them with postmasters assuming a 50 hour week and 52 week year. Finally, we form the 1910 and 1920 distribution of wages using the wages paid to police detectives as collected by the Bureau of Municipal Research of Philadelphia (1916). We treat all of these wages as urban wages.

Wages by state for Communication and Miscellaneous Transportation, Professional Services, and Personal Services. We use Transportation for Communication, Education wages for Professional Services, and Trade for Personal Services. These services have a reasonably close approximation to the skill mix in the services for which good wages are difficult to find.

Value added by state for Finance, Insurance, and Real Estate. For FIRE we instead use the banking capital by state to allocate national value added. For for 1880-1910 we use the total assets in national banks in each state collected from the annual report of the Comptroller of the Currency by Weber (2000). For 1870, we use the capital of individual banks aggregated to the state level collected by Fulford (2015). We assume that the distribution of capital in 1850 and 1860 is the same as in 1870 and 1920 is the same as 1910. The 1870 assumption is problematic since the banking capital of the south was largely destroyed by the Civil War, and there were few national banks in the south by 1870. We allocate urban versus non-urban GDP using the same approach we have used when we know wages. Within each state in rural areas $Y_i^{Nr} = \frac{uc}{\alpha}\theta\tilde{K^r}_i = w_i^r L_i^r/(1-\alpha)$. Then since $\tilde{K}_i = \tilde{K}_i^r + \tilde{K}_i^u$ and $\tilde{K}_i^r/\tilde{K}_i^u = (w_i^r L_i^r)/(w_i^u L_i^u)$, we can use the 1940 distribution of wage compensation in each state between urban and rural in FIRE, the labor in FIRE in urban and rural in each year, and the total capital in each state to allocate the state capital between urban and rural counties.

B.2.3 Measures of services, mining, and construction at the national level 1850-1960

The construction of value added for services, mining and construction at the national level varies by sub-period depending on the information available.

Value added per worker by services category 1840-1900. Gallman and Weiss (1969) construct measures of services value added and employment for eight categories at a national level from 1840 to 1900: trade; transportation and public utilities; finance professional services, personal services, government, education, and "hand trades." Hand trades are composed of smithing, shoe repair, and tailoring. These activities are technically manufacturing (they are constructed by hand or *manus*), but by the time formal national accounts were constructed in the 1950s had become part of services. Since the census includes output from the hand trades as manufacturing, we exclude them to avoid double counting. Combined with the Gallman and Weiss (1969) estimates of the labor force in each category, we create a measure of the value added per worker.

Value added per worker by services category 1930-1960. The National Income and Product Accounts (United States Department of Commerce, 1993) break down by industry the product (p. 104) and "persons engaged in production" (p. 122) which includes full time employees, part-time employees, and the self-employed. Since the census samples we use at the county level do not distinguish between full and part-time work or self-employment, the broad measure best matches the county data we use. We use the equivalent tables in United States Department of Commerce (2001) to construct nominal value added per worker engaged in production for the post-war period.

Constructing value added for services in 1910 and 1920. No estimates connect the Gallman and Weiss (1969) and United States Department of Commerce (1993) estimates of services value added by category. Since our goal is to correctly capture the relative value of different services, and their relationship to other productive activities, we interpolate the national value added of service categories in 1910 and 1920 based on 1900 and 1930. Since both prices and real activity increased rapidly over the period, the interpolation method matters. Linear interpolation, for example, is not a good choice because overall growth rates differ by decade. Linear interpolation of current dollar values between 1900 and 1930 tends to overstate growth from 1910 to 1920 since overall real GDP grew faster from 1900 to 1910 than 1910 to 1920 while prices grew faster from 1910 to 1920. So we first convert value added by each service category to real values using the GDP price deflator from Sutch (2006). Then we allocate growth in each decade in each service category from 1900 to 1930 to match the growth of real GDP per capita 1900 to 1930.[3] Note that we do not require the growth in service categories to be the same (some categories had almost no real growth over the period), only that where there is growth the proportion that takes place between 1900 and 1910 be the same as for overall growth. We finally obtain nominal quantities of (national) service value added for 1910 and 1920 by multiplying by the GDP price deflator from Sutch (2006).

Value added for construction and mining. We use the values of mining and contract construction from the National Income and Product Accounts in 1930 and 1940 to construct national value added per worker. From 1880 to 1920 we also use the estimates of Wright (2006) for mining. From 1850 to 1870 we use the ratio of the value added per worker in mining to the value added in transportation in 1880 times the value added per worker in transportation in 1850, 1860, and 1870. This approach assumes that the value added in transportation and mining grow at the same rate from 1850 to 1870. An important part of the value of mineral and fuel extraction comes from transporting it to populated areas. Transportation value added per worker grew at close to the same rate as overall national product per person during the period. Our approach for construction is similar but involves even stronger assumptions. Construction value added per worker before 1930 is simply its ratio to national income per person in 1930 and 1940. This approach assumes that construction value added grows at the same rate as the national economy, and that employment in construction is a good measure of the distribution of construction activity. Construction is a relatively small

[3] Let y_{1900} be real national GDP per capita in 1900. Then a fraction $f^y_{1910-1900} = (y_{1910} - y_{1900})/(y_{1930} - y_{1900})$ of that growth took place between 1900 and 1910. We assume the same fraction of growth in each service category took place between 1900 and 1910. So for some service category s we observe value added per person y^s_{1900} and y^s_{1930} then we calculate $y^s_{1910} - y^s_{1900} = f^y_{1910-1900} * (y^s_{1930} - y^s_{1900})$.

component of GDP—it composed only 5% of national product in 1950 and our estimates suggest it was smaller before that—and this approach puts a reasonable value on construction.

B.3 Income 1950-2010

Starting in 1950 official statistics report measures of personal income per capita at the county level. We combine the county level income data from the County Data Books (United States Census Bureau, 2012) with the county income from the census in 1980, 1990, 2000, and the combined 2008-2012 American Community Survey collected by Minnesota Population Center (2011). In 1950, the census only reported median household income at the county level, while in other years we have mean income per person. To account for this discrepancy we multiply the 1950 median household income by the mean income to median income ratio in 1960 for each county. This approach is exactly correct if growth from 1950 to 1960 was entirely mean shifting, leaving the distribution unchanged, and family sizes did not change.

B.4 County output for 1950

Starting in 1950, the census micro-samples no longer report the current county of residence so it is no longer possible to construct county employment shares by industry. The City and County Databooks (United States Census Bureau, 2012) provide measures of employment in 1950 and 1960, as well as manufacturing and agricultural products sold.

The manufacturing values in the the Databooks are reported as value added in 1947, 1954, 1958, and 1963. Rather than taking the linear average, which misses the rapid growth during the period, we take the average growth rate in each county from 1947 to 1954, and use the county specific growth rate for three years starting in 1947. We use the same method to update 1958.

The agriculture values in the Databooks give the total value of farm products sold in 1950 and 1959 which we use to construct agriculture in 1960 by multiplying the county value by the nominal national increase in the total output in agriculture from 1959 to 1960 in series K 220-239 in United States Census Bureau (1975). Since these values do not include farm products consumed by farm households, we adjust both for value added and consumption using series K 220-239 in United States Census Bureau (1975). Own consumption was slightly more than 6% of total farm output in 1950. Of much larger importance is the value of intermediate inputs which were close to 40% of total output in 1950.

The Databooks report “Mining Industries Employees” in 1939 which we use for 1940 without adjustment, and 1958 and 1963 which we apply to 1960 by taking the county specific linear average. The Databooks report a value added measure of mining in 1963, but we continue to use the employment based measure for consistency with earlier estimates.

In 1950 and 1960, the Databooks report the employees in construction; manufacturing; transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; and overall employment. The reporting in the Databooks for some counties is problematic, since some counties have more employment listed in a given category than overall. To create a less error filled employment variable, we take the larger of civilian and total employment (total employment is not always larger). Personal and professional employees are only reported in 1950, and government employees only in 1970. We use overall employment to construct a residual government and personal employment in 1950 and 1960 by subtracting out the other categories and setting the residual to zero if it would be negative. The residual in 1960 contains both government and personal services, we divide between them using the fraction of personal in personal and government services in 1950.

With employment totals we find a value added of services using the same method as for 1940 and earlier. Using Tables 6.1B for national income by industry and 6.8B “Persons engaged in production” in United States Department of Commerce (2001) gives an average product per employee per industry which combine with employment by industry in each county to create a measure of value added by county by industry.

B.5 Aggregate output and its composition

Although our goal is to create for each decade a measure that correctly captures the relative GDP across counties, we can also construct an estimate of the national GDP by summing across counties. Figure A-2 shows real GDP per capita as constructed by Sutch (2006), which includes services, and our measure of county GDP summed over all counties and divided by population. Figure A-2 suggests that our measure is a good approximation of the level of aggregate output and captures the change over time. Part of the reason for this close relationship is that the construction of the historical GDP at the national level relies on many of the same sources we have used at the county level such as the national estimates of manufacturing and agriculture output.

B.6 Combining income and output measures

From 1850 to 1960 we have created something close to GDP per worker for each county. Starting in 1950 we have an income based measure from the census. These two measures are not the same; in each decade from 1950 to 2010, the sum of county aggregate incomes from the census is less than GDP from the national accounts. Income leaves out a number of categories such as owner occupied rent that are included in GDP. A a county level, moreover, income, which can include profits from activities elsewhere, need not be the same as a measure of the gross domestic product produced in a county. We use the overlap of our income measure and GDP measure in 1950 to combine the two series to create a measure of GDP over the entire time period. More specifically, we assume that GDP and income grow at the same rate from 1950 onward and use the growth rate of income to create a measure of county level nominal GDP. Once we have GDP, we can convert to GDP per worker using population and employment measures. Some counties have GDP-to-income ratios that are extreme because the constructed value of county GDP is low.

Finally, we deflate our constructed measure of county level nominal GDP by the GDP deflator in Sutch (2006), updated using Bureau of Economic Analysis tables on GDP and the GDP deflator.

C Creating a density of arrival times

Immigrants arrived at different times and we would like to reflect what immigrants brought with them by the conditions in their country of origin at the time of immigration. Doing so requires knowledge of the conditional density of immigration over time so that, for example, the Irish coming in the 1850s reflect different experiences than the Irish in the 1890s, both of whom are different from the Italians in the 1910s. Our ancestry measure captures very well the stock of people whose ancestors came from a country of origin. Since it is a stock, however, changes in it reflect both increases from migration, but also natural changes from births and deaths. We therefore turn to immigration records that contain the number of migrants arriving from different countries starting in the 1820s (Department of Homeland Security, 2013) at a national level. In 1850, we create a density of arrival times for the stock of migrants in 1850 based on Daniels (2002). The division is appropriately coarse given the limited information, and so only divides between arrivals in 1650, 1700, 1750, 1800, and 1850. For example, we allocate all of the Netherlands arrivals to 1700, and divide the English migrants to between 1650 and 1750 to reflect the later migration of lowland Scots and Scotch-Irish. Using our ancestry vector and county population, we create a stock of total population of ancestry a in time t: P_t^a. The immigration records then record the number of migrants I_{t+1}^a from country a over the decade from t to $t+1$. The density $F_t^a(\tau)$ gives the density of arrival times τ of the descendants of the population of ancestry a at time t (which is by definition 0 for all $\tau > t$ since it is a conditional density). Given this definition, the size of the population in year $t+1$ who did not immigrate at $t+1$ and are descended from people who migrated in year τ is $(P_{t+1}^a - I_{t+1}^a)F_t^a(\tau)$. Starting from an initial $F_t^a(1600) = 0$, we update the conditional density based on immigration records using:

$$F_{t+1}^a(\tau) = \frac{(P_{t+1}^a - I_{t+1}^a)F_t^a(\tau) + I_{t+1}^a 1(\tau = t+1)}{P_{t+1}^a}, \tag{3}$$

where $1(\tau = t+1)$ is an indicator which is one if $\tau = t+1$.

It is useful to see how this formula works. If $\tau = t + 1$ and so we want to know the share of the population in year t+1 descended from people who came in year $\tau = t + 1$, then since $F_t^a(t+1) = 0$ (the conditional arrival for the future is zero), the share of the population is just the new migrants share of the total stock: I_{t+1}^a / P_{t+1}^a. On the other hand, if $\tau < t + 1$ is in the past, $1(\tau = t + 1) = 0$, then updating the density is simply adjusting the fraction of the current population that migrated in τ: $(P_{t+1}^a - I_{t+1}^a) F_t^a(\tau) / P_{t+1}^a$ since new migrants dilute the share of old migrants in the total stock. Since this formula updates the density at t by the fraction of new migrants between t and $t + 1$ compared to the total stock. For example, the density changes only slightly for the English between 1880 and 1890, despite more than 800,000 migrants because the stock is so large, while the 1.4 million German immigrants significantly shift the arrival density of Germans because of the smaller stock.

We modify this approach slightly for smaller immigrant groups. Immigration records group some countries together and information is not available for all countries. We assign the density of arrival times to similar countries, or from the overall group. For example, we assign the arrival times of "Other Europe" in the immigration records to Iceland. However, the total migration from all of "Other Europe" is larger than our estimates of the population descended from Iceland migrants in most years. We assume that the arrival of migrants is proportional to the larger group (or similar country), and scale the number of migrants so that the population implied by the immigrant records is no larger than the population implied by the census records. In particular, define a projected population that would come from immigration and natural increase from growth rate g:

$$\hat{P}_t^a = \sum_{\tau=t}^{-\infty} (1+g)^{t-\tau} I_\tau^a.$$

$\hat{P}_t^a$ is the population that would occur if all immigrants came and then grew in population at growth rate g. Then define:

$$\omega^a = \max_t \frac{\hat{P}_t^a}{P_t^a}$$

as the maximum ratio of the projected population based on the (too large) immigration records and the population descended from group a. We then define the scaled immigration of the particular group as $\hat{I}_t^a = I_t^a/\omega^a$ which scales the number of migrants to the overall population of that group.[4]

Austria-Hungary and its constituent countries pose a special problem. At least some Czech and Slovak migration (which are record together as Czechoslovakia) appears to be part of the Austrian migration in the immigration records since our ancestry calculations suggest a substantial Czechoslovakia presence from 1900 to 1920, while the immigration records show few migrants. Similarly, Poland was divided among Austria, Hungary, Germany, and Russia in the decades ending in 1900, 1910, and 1920 during a period of peak migration. We assign a fraction of Austrian migration to Czechoslovakia, and a portion of German, Hungarian, and Russian migration to Poland. The fractions are approximate based on the relative populations in 1910.

Several groups have a special set of arrival times that are more or less by assumption. We assign African Americans an arrival of 1750. Significant groups of Native Americans are first counted in the census or forced to move to new areas after 1850. We assign them an "arrival" of 1840, acknowledging that giving an indigenous group an arrival time is problematic, but think of it as representing an approximate density of the start of substantial contact with other groups, with all of its many, often negative, consequences. Puerto Rico similarly represents a complicated situation since Puerto Rican's have been US. citizens since 1917, but the data used to track Puerto Rico the same way as the rest of the US counties is only sporadically available. We allocate a small mainland migration in 1910 and a much larger one in 1960 to match the ancestry population totals.

While the density is approximate it still provides very useful information that matches immigration narratives. For example, the 2010 density gives the average decade of arrival for each ancestry living in 2010. Most Irish are descended from immigrants who arrived in the 1840s, with

[4] The procedure is slightly more complicated for small countries where measurement error in either our measure based on samples from the census, or immigration statistics can produce very large ω^a. We define ω^a as the maximum ratio of projected to census population when the census population is at least 100,000. If the ancestry never reaches 100,000, we still use the overall maximum. Finally, if this procedure produces an immigration flow larger than our projected population, we set the density equal to 1 in that year.

substantial populations in the 1850s and 1860s, but few afterwards compared to the large population. Based on these calculations, more people of Chinese ancestry are descended from people who migrated from 1860 - 1880 than the second wave of Chinese migration from 1970-2010. Far more migrants came later, but the early migrants had already established a population which grew over time and which we track geographically with the census calculations. Other Asian migrants have come mostly since 1970, except the Japanese who are mostly descended from early migrants.

D Constructing country of origin measures

D.1 Origin Country GDP

This section briefly details how we fill in the gaps left in origin country GDP per capita in the Bolt and van Zanden (2013) update of Maddison (1995). Some crucial countries of origin are not available for all dates going back although some information is available. We fill in missing data by making reasonable assumptions about the likely relationship within other countries or the same country on surrounding dates. The most important of these is Ireland which did not obtain independence until 1921, and has only spotty estimates of income separate from the United Kingdom. We use the ratio of Irish to UK GDP in 1921 to fill in dates from 1880 to 1920, and the ratio of Irish to UK in 1870 to fill in dates before that. While this approach will clearly miss Irish specific events such as the potato blight, our goal is to get the relative incomes appropriately.

Little information is available for countries in Africa. Ghana, a British colony, has estimates in 1913 and 1870 and yearly starting in 1950 (Ghana was the first African country to achieve independence in 1957). We linearly interpolate between 1870, 1913, and 1950, but since the value in 1870 is close to subsistence (439 in 1990 $) we set 1850 and 1860 to 439.

The West Indies is a birthplace for a substantial portion of the population in some areas early on. We use the post-1950 Maddison numbers for the Caribbean. We take the ratio of the Caribbean to Jamaica between 1913 and 1950 when there are no overall Caribbean numbers listed, interpolate between years 1900 to 1913, and again use the ratio of Caribbean to Jamaica between 1900 and 1870, and again prior to 1870.

Latvia, Lithuania, and Estonia have some early migration (small overall). They are combined where there is data on them separately, but we use the ratio with overall Eastern Europe to go back earlier.

Puerto Rico has a special status. It has been a US possession since 1898, and after 1950 there was significant migration to the mainland. We treat Puerto Rico as a separate ancestry recognizing its distinct culture. The ancestors of Puerto Ricans appear to be a combination of Spanish, Africans brought as slaves, and a mix of other immigrants. We assign Puerto Rico its own GDP after 1950, but before that give it the Caribbean GDP adjusted for the Puerto Rico-to-Caribbean ratio in 1950.

The Pacific Islands (a birthplace in the census) as well as American Somoa represent a similar problem to Puerto Rico. We create a Pacific Islands (including Somoa) GDP per capita by taking the ratio of Fiji and Indonesia in 2010 (source: World Bank, 2010 International $PPP) and using the Indonesian GDP going back in time.

We create Latin America GDP before 1870 as the ratio of Argentina, Brazil, and Colombia in 1870 times their average before that. Mexico is always separate, so Latin America excludes Mexico as an ancestry.

Israel is complicated in the past since it had substantial migration to create the modern state. We assign the Lebanon GDP to Israel/Palestine before 1950. Note that Jewish migration from Europe to the US is measured as the country of origin in Europe.

Afghanistan has the India GDP in 1870, and its own after 1950.

For smaller countries (with comparably small migrations) where information is missing we assign them to a comparable larger country. We assign Lichtenstein, Monaco, and Andorra the French GDP; San Marino, Vatican City, Malta, and Cyprus the Italian GDP; Gibraltar the Spain GDP; Lapland n.s. the Finland GDP. All of Eastern Europe n.s., Central Europe n.s., Eastern Europe n.s., and Southern Europe n.s. get the Eastern Europe overall GDP.

D.2 Culture Measures from the World Values Survey

We construct measures of several cultural attitudes from the European Values Survey and the World Values Survey. We use an integrated version of the survey that combines both sources and utilized each of the six waves available between 1981 and 2014. The cultural endowment is inferred from the answers to six survey questions:

Trust: A measure of generalized trust is estimated from the responses to the question: “Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" We calculate the proportion of the total respondents from a given nationality that answer that "most people can be trusted." An alternative response to this question is that one "can't be too careful."

Control: As a measure of the attitude towards one's control over personal circumstances we use the answer to the question: "Some people feel they have completely free choice and control over their lives, while other people feel that what they do has no real effect on what happens to them. Please use this scale where 1 means "none at all" and 10 means "a great deal" to indicate how much freedom of choice and control you feel you have over the way your life turns out." In particular, we take the average response by nationality for all countries in our dataset.

Respect, Obedience, and Thrift: To measure the attitude toward authority and towards saving behavior we use the following question from the survey: "Here is a list of qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important? Please choose up to five." There are 17 possible qualities listed. We estimate the proportion of people by nationality that respond that "tolerance and respect for other people" is important to measure Respect and the proportion of people that respond that "obedience" is important to measure Obedience. To measure the importance of saving we estimate the proportion of people that respond that "thrift saving money and things" is important.

Holiday: To measure the attitude towards leisure we use the response to the question: "Here are some more aspects of a job that people say are important. Please look at them and tell me which ones you personally think are important in a job?" Similarly to the questions regarding important qualities in children this question has 18 different aspects. We use the fraction of people that respond that "generous holidays" is an important aspect in a job to proxy for the attitude towards leisure.

Following Tabellini (2010) we also form the first principal component of the combined attitudes Trust, Control, Respect, and Obedience at the individual level, and then take the average of the principal component for each country.

In order to obtain a time-varying measure of culture, we separate the individual WVS answers by birth cohort (born before 1925, 1925–1949, 1950–1974, after 1975) and apply them to immigrants who came in those years. This procedure allows us to capture, albeit imperfectly, the changing cultural values inherited from the country of origin by different waves of immigrants. We then take differences from the US depreciated at 0.5% per year to form the arrival-weighted Principal Component of Culture using equation (2) in the main main paper.

D.3 Immigrant Education

In this section, we describe how we measure immigrant education, attempting to capture the human capital compared to the United States at the time, of the immigrants when they arrive. Combined with the density of arrival times, the measure of new immigrant education gives an average arrival weighted education.

The census records the birthplace, so we know the education of immigrants, but does not record the year of arrival. For example, although the census records the Italians who were in the US. in 1910, we do not know which of them arrived between 1900 and 1910. We make the assumption that recent migrants are those who were born in a foreign country and are between 20 and 30 as of the age census. Most of the large waves of migration were primarily among young people, although some migrants brought their families and so came as children. Taking the 20-30 year olds thus mixes some people who came recently with some who may have come as children and so received an their education in the United States. In 1850 we assign the literacy of the 30-40 years olds migrants to the 20-30 year olds migrating in 1830-1840. For 1890 when the census micro-samples were destroyed we assign the literacy of the 30-40 year olds in 1900. For African Americans we use the education level as of 1900 since there were rapid gains in literacy after the civil war which slowed after 1900. For Native Americans we use the literacy levels as of 1900 which is the first year that Native Americans are recorded extensively.

The micro-samples from the census record the education as well as the birthplace. Before 1940 the census only records literacy, while after that it records years of education. Since we want to create a measure that captures the average relative education of migrants, we must combine these disparate measures so that we can compare the relative education of later migrants with early ones. We take the difference of the 20-30 migrant literacy for each ancestry from the non-migrant US education of 20-30 year olds before 1940, and use years of education starting in 1940.

To create a composite education variable, we adjust the literacy difference to be in units of years of education. To do this we take the demographic groups that are age 30-40, 40-50, and 50-60 in 1940 for whom we observe their education, and compare the literacy of the same ancestry groups who were 20-30, 30-40, and 40-50 in 1930. For each ancestry age group we create the difference between its years of education and the native years of education in 1940 for the same age group. We do the same things for literacy in 1930. Regressing the difference in years of education in 1940 each age-ancestry group the difference in literacy for the same age groups on the same age groups 10 years younger in 1930 then gives a prediction of how literacy converts to the US years of education on average. We use this prediction to adjust the literacy difference before 1940 in units of years of education.

D.4 Executive Constraint

We build a comparable measure of executive constraint on arrival by combining the measure of executive constraint from POLITY IV and Acemoglu, Johnson, and Robinson (2005). Since not all important countries are covered in years of migration, we fill in some values based on nearby years or comparable countries.

E Sorting, endogeneity and instrumental variables estimates

In this section we present more details and robustness for the IV and GMM estimates.

E.1 Building a measure of closeness to the transportation network and migration for Approach 2

Closeness to the transportation network: In this section, we discuss how we have constructed a measure of the closeness of a county to the transportation network (d_{ct}). Let I_{ct}^R and I_{ct}^H be indicators for whether the county group has a railroad or interstate highway at t, and $DistNew_{ct}^R$ and $DistNew_{ct}^H$ be the distance in degrees to new railroad or highways constructed between t and $t-1$ (which is zero if the construction is in the county). Then we form an index of distance $D_{ct}^R = 1 - \ln(1 + DistNew_{ct}^R)/\max_c \ln(1 + DistNew_{ct}^R)$ which is its maximum 1 in a given year if new construction is in a county and minimum 0 if the county is the farthest from new construction. To capture that new construction no longer matters once a county is connected, we set $D_{ct}^R = 0$ if $I_{ct-1}^R = 1$. Defining total migration $TM_t^A = (I_t^a + M_t^a)$ and $\Delta P_{ct}^{a,M} = P_{ct}^a - P_{ct-1}^a \left(1 + \frac{\Delta P_t^{NM}}{P_{t-1}}\right)$,we estimate a "zero" stage regression to find the weights to combine these indexes:

$$\Delta P_{ct}^{a,M} = \beta_1(D_{ct}^R \times TM_t^A) + \beta_2(I_{ct-1}^R \times TM_t^A) + \beta_3(D_{ct}^H \times TM_t^A) + \beta_4(I_{ct-1}^H \times TM_t^A) + X_{ct}\beta + \epsilon_{ct}^a,$$

where X_{ct} includes each of the indexes themselves (D_{ct}^R, I_{ct-1}^R, D_{ct}^H, and I_{ct-1}^H), P_{ct-1}^a, GDP per worker (y_{ct-1}), and indicators for state and year. The results are in Appendix Table A-3. We form $d_{ct} = \hat{\beta}_1 D_{ct}^R + \hat{\beta}_2 I_{ct-1}^R + \hat{\beta}_3 D_{ct}^H + \hat{\beta}_4 I_{ct-1}^H$. Note that we normalize this index in our construction of the instrument, so that its absolute level does not matter and the only information used from the zero stage regression is to get the relative weights for the different index. We have also formed d_{ct} setting the weights to one ($\beta_1 = \beta_2 = \beta_3 = \beta_4 = 1$) and get similar results below. However, using the zero stage regression to form the weights is somewhat more efficient, yielding a higher correlation of $\hat{\pi}_{ct}$ with π_{ct}. Because the railroad network was complete by approximately 1920 and the interstate began construction in the 1950s, the railroad and highway indicators are changing at different times.

Measures of international and internal migration by ancestry: To use Approach 2, we form international migration from country a between t and t-1, I_t^a, using the same method described in Appendix C. To form internal migration, M_t^a, we turn to census records. For each state, we calculate the population in that state that was born in the United States but outside the state of residence. We apply our standard ancestry calculation based on state and year of birth (or if second generation, the ancestry of the parents) to form an estimate of the ancestry vector for each person, then sum across all individuals to form an estimate of the stock of internal migrants in a given state of ancestry a. To form M_t^a, we take the sum across all states of the differences in the stock of people of ancestry a born out of state between t and $t-1$. The difference in stock likely understates the internal migration for all ancestries because the stock can change both because of death and internal migration. The understatement applies equally to all ancestries as long as death rates of second and higher generation cross-state movers are similar. Our construction of the non-moving population growth rate uses M_t^a and so still returns the correct overall population. Because we use these estimates to form an instrument, forming internal migration using a change in stock only matters to the extent it affects ancestries differently, which does not seem likely.

We also construct a different measure of $\hat{P}_{ct}$ and $\hat{\pi}_{ct}$ using a measure of the flow of new immigrants and internal migrants, that excludes the migration flows that go to the county's state by subtracting from I_t^a and M_t^a the changes in stock of first generation immigrants or higher generation migrants from other states recorded in the census. Denote this new measures for county c as $I^a_{-s(c),t}$ and $M^a_{-s(c)t}$, where $-s(c)$ indicates the total migration minus the state of c. This approach removes any county-specific and even state specific pull factors that may affect the total flow of external or internal migrants. The results obtained when the instrument is constructed using this revised measure of $\hat{P}_{ct}$ and $\hat{\pi}_{ct}$ are reported in Table A-4 and are very similar to those reported in the main text.

E.2 Closeness interacted with past development as additional control in the first and second stage of Approach 2

In Table A-4, we also report results for Approach 2 that include the interaction between closeness to the transportation network and once lagged development as a control in stage 1 and 2. The results are very similar to those reported in the main text (see Table 2 and 4).

E.3 Robustness and more details for GMM estimates

In Table A-5 we report additional variations of the GMM results, using both forward orthogonal deviations and first differences.[5]

Using first differences for the log GDP per worker equation, the impact coefficient goes down somewhat relative to the one obtained using orthogonal deviations, but is still highly significant (compare column 1 and 2). In the third column, we show the same specification as in column 1, but only include year effects, not Division X Year effects. the results are also very similar. Finally, the last two columns address endogeneity by estimating the reduced form of a bivariate panel Vector Auto-Regression (VAR) following Abrigo and Love (2015) for log GDP per worker and *Origin GDP*. We remove unobserved fixed heterogeneity using forward orthogonal deviations. The impulse responses from the panel VAR are in Figure 6 in the main paper.

F Creating an index of occupational variety

In this section, we give the details for our construction of an occupational variety index. Assume GDP per worker in county c at time t depends, in a separable fashion, on capital per worker and a

[5]The forward orthogonal deviation transformation subtracts from the value of a variable the forward mean (and rescales the results appropriately). This transformation has the property that if the original errors are i.i.d., they maintain this characteristic after the transformation. Twice or more lagged values of z_t^a and y_{ct} are legitimate instruments in this context.

CES aggregate of occupations j:

$$\frac{Y_{c,t}}{L_{c,t}} = F\left(\frac{K_{c,t}}{L_{c,t}}, \left[\sum_{j=1}^{J} a_{c,j,t}(s_{c,j,t}/L_{c,t})^{\epsilon}\right]^{1/\epsilon}\right).$$

Profit maximization then implies that the weights in the CES aggregate of occupations are given by:

$$a_{c,j,t} = \frac{w_{c,j,t}s_{c,j,t}^{1-\epsilon}}{\sum_j w_{c,j,t}s_{c,j,t}^{1-\epsilon}}.$$

We calculate $a_{c,j}$ using data for the year 1940 for which the full sample is available and we observe wages. 1940 is close to the middle of the period and is the first period we observe individual wages. Note that if different occupations are assumed to exhibit differential complementarity with capital, matters become more complex and it is not possible to summarize occupational variety in a single index.

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Table A-1: Correlation across county groups between Ancestry and self-reported Ethnicity/Ancestry in 2000 US Census

	Average county share	Correlation
Overall Correlation		0.966
England	0.332	0.939
Germany	0.143	0.918
African American	0.104	0.988
Ireland	0.069	0.864
Italy	0.041	0.938
Mexico	0.039	0.980
Canada	0.038	0.841
Russia	0.024	0.587
Poland	0.023	0.901
Austria	0.017	0.618
Sweden	0.015	0.946
Netherlands	0.014	0.934
Norway	0.011	0.961
Native American	0.009	0.950
Philippines	0.004	0.989
China	0.004	0.985
Vietnam	0.003	0.974
Jamaica	0.002	0.980
Haiti	0.001	0.983
Nigeria	0.001	0.805

Notes: This table shows the geographic correlation across county groups between our measure of ancestry and self-reported ethnicity/ancestry in the 2000 US census. Because our unit of analysis is the countygroup, we do not weight by population, and so the average county share is not the share of the population. African American does not include specific African country ancestries. For self-reported ancestry/ethnicity, England includes self-identified "American" ethnicities.

Table A-2: Descriptive statistics

Year	1870	1890	1910	1930	1950	1970	1990	2010	All years
					Overall US				
Number of countygroups	988	1047	1130	1143	1146	1146	1146	1136	
Population covered (millions)	38.21	61.79	92.01	122.65	150.43	201.83	246.47	303.41	
Ancestries >1% of population	8	10	18	19	19	19	25	26	
Ancestries >5% of population	4	4	4	4	4	5	4	5	
Overal US fractionalization	0.697	0.748	0.828	0.858	0.853	0.864	0.877	0.894	
					County group averages				
Real GDP per worker	5639	8448	11559	13922	22488	42446	51811	65784	27572
Log Real GDP per worker	8.536	8.907	9.252	9.440	9.969	10.618	10.814	11.057	9.836
S.D.	0.478	0.537	0.505	0.471	0.337	0.276	0.291	0.270	0.942
Inter-quartile	0.700	0.802	0.655	0.666	0.451	0.390	0.391	0.344	1.548
log Origin 1870 GDP per capita	2419	2332	2161	2104	2146	2086	1998	1877	2124
S.D.	441	416	370	355	362	325	361	362	398
Inter-quartile	464	496	465	497	519	418	471	480	556
log Origin GDP per capita	-0.159	-0.215	-0.292	-0.315	-0.264	-0.277	-0.311	-0.364	-0.284
S.D.	0.328	0.311	0.265	0.205	0.176	0.150	0.177	0.184	0.236
Inter-quartile	0.266	0.270	0.240	0.276	0.244	0.190	0.219	0.247	0.285
Migrant Education	-1.340	-0.971	-1.026	-1.016	-0.859	-0.843	-0.801	-0.768	-0.954
S.D.	1.609	0.900	0.674	0.533	0.470	0.385	0.369	0.328	0.739
Inter-quartile	0.177	0.138	0.132	0.127	0.118	0.088	0.075	0.058	0.133
Origin Trust	-0.074	-0.075	-0.079	-0.077	-0.066	-0.063	-0.061	-0.060	-0.070
S.D.	0.064	0.062	0.053	0.039	0.033	0.026	0.027	0.026	0.044
Inter-quartile	0.060	0.058	0.053	0.053	0.046	0.036	0.037	0.035	0.046
Origin PC Culture	-0.171	-0.174	-0.186	-0.186	-0.157	-0.154	-0.152	-0.153	-0.168
S.D.	0.152	0.149	0.129	0.099	0.084	0.070	0.072	0.068	0.108
Inter-quartile	0.124	0.119	0.136	0.147	0.125	0.103	0.102	0.101	0.122
Origin State history	0.630	0.621	0.607	0.601	0.606	0.600	0.587	0.572	0.601
S.D.	0.082	0.078	0.073	0.067	0.068	0.060	0.068	0.065	0.072
Inter-quartile	0.085	0.097	0.097	0.088	0.088	0.071	0.084	0.086	0.095
Ancestry fractionalization	0.606	0.644	0.717	0.749	0.738	0.782	0.800	0.826	0.740
S.D.	0.112	0.112	0.121	0.125	0.130	0.106	0.101	0.088	0.129
Inter-quartile	0.148	0.150	0.173	0.189	0.191	0.153	0.141	0.117	0.193
Origin GDP weighted fract.	0.116	0.120	0.128	0.130	0.114	0.114	0.118	0.128	0.122
S.D.	0.069	0.066	0.059	0.046	0.042	0.032	0.034	0.035	0.050
Inter-quartile	0.092	0.077	0.076	0.059	0.060	0.047	0.054	0.051	0.064

Notes: This table shows descriptive statistics for the overall US (the top panel) and the average for county groups (the bottom panel). Origin variables are ancestry weighted within each county group using the ancestry fractions as weights. County group averages are not weighted by population since the regressions treat each county group as its own observation. Inter-quartile is the range from the 75th percentile to the 25th percentile. The last column shows the average over all county groups and years since 1870. See the text for the construction and definition of indices and ancestry and sources of the country of origin variables.

Table A-3: Zero stage

	$\Delta P_{ct}^{a,M} = P_{ct}^{a} - P_{ct-1}^{a}\left(1 + \frac{\Delta P_t^{NM}}{P_{t-1}}\right)$
$(D_{ct}^R \times TM_t^A)$	0.00153***
	(2.95e-05)
$(I_{ct-1}^R \times TM_t^A)$	0.000717***
	(1.05e-05)
$(D_{ct}^H \times TM_t^A)$	0.000345***
	(1.77e-05)
$(I_{ct-1}^H \times TM_t^A)$	0.000623***
	(1.34e-05)
D_{ct}^R	12.68
	(51.99)
I_{ct-1}^R	57.49
	(49.42)
D_{ct}^H	86.98***
	(15.83)
I_{ct-1}^H	56.65***
	(14.56)
P_{ct-1}^a	-0.0212***
	(0.000204)
GDP per worker (y_{ct-1})	105.2***
	(5.034)
Observations	1,702,899
State Effect	Yes
Year Effect	Yes
R^2	0.0236

Notes: This table shows the “zero” stage regression to form the weights for the transportation index d_{ct} in instrument approach 2. See text for the full definition of variables.

Table A-4: Robustness of transportation instrument (Approach 2)

	Dep. Variable: Log(County group income per worker)				
	IV2-FE	IV2-Leave out state		IV2-FE	IV2-FE
	[1]	[2]	[3]	[4]	[5]
Origin GDP	0.300***	0.305***	0.288***		0.0438
	(0.0429)	(0.0422)	(0.0424)		(0.0682)
Migrant education				-0.00838	
at arrival				(0.0557)	
Principal Component				0.756***	
of culture				(0.287)	
State history				0.126	
				(0.541)	
Fractionalization					1.593***
					(0.246)
Origin GDP weighted					-2.622***
fractionalization					(0.467)
Decade lag	0.505***	0.457***	0.507***	0.502***	0.474***
log county GDP	(0.0273)	(0.0169)	(0.0272)	(0.0285)	(0.0298)
Two decade lag	0.0500***	0.0514***	0.0500***	0.0516***	0.0439***
log county GDP	(0.0126)	(0.0125)	(0.0126)	(0.0129)	(0.0127)
Distance to transportation index	451.6**	-47.87*	464.5**	441.8*	349.4
	(221.1)	(27.72)	(221.3)	(228.6)	(242.6)
Index X lag log county GDP	-53.98**		-55.34**	-53.05**	-40.94*
	(21.90)		(21.90)	(22.80)	(24.02)
Observations	13,232	13,233	13,232	13,232	13,232
Division X Year	Yes	Yes	Yes	Yes	Yes
County group FE	Yes	Yes	Yes	Yes	Yes
County groups	1023	1023	1023	1023	1023
AB test serial corr.	0.800	0.893	0.790	0.0539	0.936
Kleibergen-Paap F	1341	1508	1383	21.89	81.73

Notes: This table shows two stage least squares results instrumenting using approach two—the interaction of migration and a transportation index. Columns 1, 3, 4, and 5 include both the transportation access index and its interaction with lag GDP per worker to control more flexibly for possibly endogenous transportation effects. Columns 2 and 3 use an instrument the predicted ancestry constructed using migration flows that leave out the county's state. Doing so removes any possible endogeneity between a county shock and the total number of people moving at a given time.

Table A-5: GMM estimates of the dynamic effect of ancestry weighted arrival origin GDP

	Single equation GMM			Bivariate VAR	
Dependent	Log(County group GDP per worker)			GDP	*Origin GDP*
Variable	[1]	[2]	[3]	[4]	[5]
Origin GDP	0.197***	0.123**	0.291***		
on arrival	(0.0357)	(0.0496)	(0.0296)		
Decade lag				0.145***	0.996***
Origin GDP				(0.0446)	(0.0151)
Two decade lag				0.0973***	-0.136***
Origin GDP				(0.0376)	(0.0123)
Decade lag	0.555***	0.500***	0.566***	0.538***	0.00911**
log county GDP	(0.0181)	(0.0271)	(0.0186)	(0.0213)	(0.00393)
Two decade lag	0.0993***	0.0495***	0.104***	0.0645***	-0.0139***
log county GDP	(0.0185)	(0.0186)	(0.0174)	(0.0184)	(0.00263)
Long-run effect	0.57	0.27	0.88		
Observations	13,269	13,265	13,269	13,233	13,233
County groups	1,146	1,146	1,146	1,146	1,146
Year effects			Yes	Yes	Yes
Year X Division	Yes	Yes			
Transform	FOD	FD	FOD	FOD	FOD
GMM instruments	1/3	2/4	1/3	1/2	1/2
AB AR(1) in diff.	0	0	0		
AB AR(2) in diff.	0.203	0.450	0.00559		
Hansen over id.	0.704	0.740	0.00657		

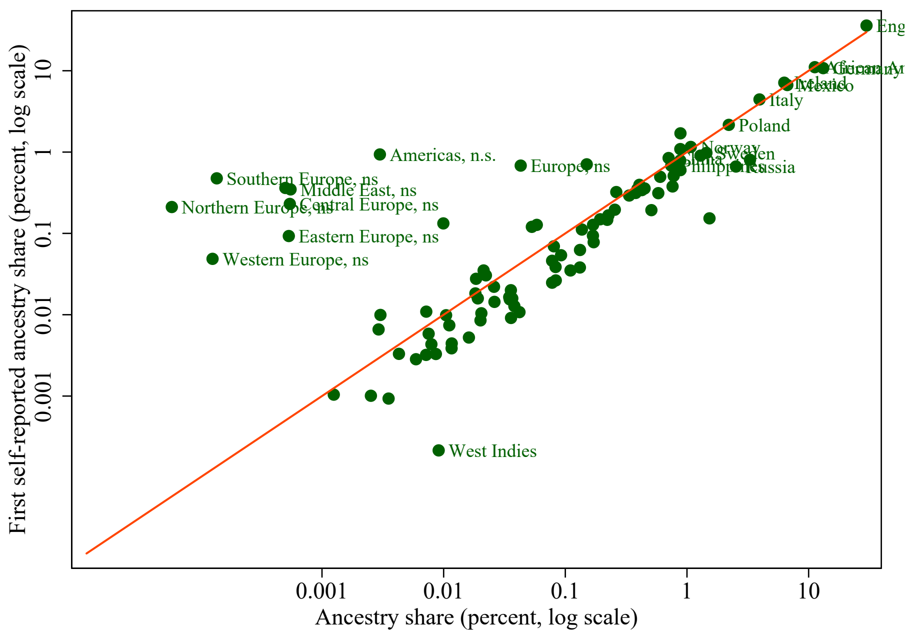
Notes: This table shows GMM estimates of the effect of ancestry-weighted *Origin GDP* on log county GDP per per worker. All regressions include either Year X Division effects or year effects and remove county group fixed effect either by Forward Orthogonal Deviations (FOD) or First Difference (FD). The lags of the instruments are reported in the table under GMM instruments. All endogenous variables have the same instruments. The line AB AR(1) and AR(2) report the p-values of the Arellano and Bond (1991) test for serial correlation in first and second differences. The Hansen over id. reports the p-value for the Hansen test of over-identifying restrictions. Columns 1-3 are estimated in Stata as single equation GMM using xtabond2 with the collapse option (Roodman, 2009), while the last columns are estimated together as a panel VAR using pvar (Abrigo and Love, 2015).

Table A-6: County GDP per worker and country-of-origin GDP: Robustness

Dependent variable:	Log(county GDP per worker)						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Origin GDP per capita	0.279***						
($\delta = 0.0\%$)	(0.0208)						
Origin GDP per capita		0.331***		0.397***	0.219***	0.270***	0.331***
($\delta = 0.5\%$)		(0.0253)		(0.0393)	(0.0307)	(0.0527)	(0.0646)
Origin GDP per capita			0.320***				
($\delta = 1.0\%$)			(0.0267)				
Decade lag	0.443***	0.445***	0.449***	0.459***	0.372***	0.441***	0.445***
log county GDP	(0.0161)	(0.0161)	(0.0161)	(0.0204)	(0.0293)	(0.0234)	(0.0678)
Two decade lag	0.0279*	0.0286*	0.0296*	0.0327**	0.0256	0.0281	0.0286
log county GDP	(0.0164)	(0.0167)	(0.0171)	(0.0163)	(0.0367)	(0.0203)	(0.0296)
Origin GDP				-0.0995**			
× In an MSA				(0.0444)			
Decade lag county GDP				-0.0269			
× In an MSA				(0.0196)			
Two decade lag				-0.00594			
× In an MSA				(0.0191)			
Indicator after 1940					2.026***		
					(0.211)		
Origin GDP					0.0403*		
× After 1940					(0.0232)		
Decade lag county GDP					-0.0206		
× After 1940					(0.0302)		
Two decade lag					-0.0716***		
× After 1940					(0.0246)		
Origin Gini						-1.469***	
ancestry weighted						(0.378)	
Observations	14,415	14,415	14,415	14,415	14,415	0.144	14,415
Division X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Countygroup	Countygroup	Countygroup	Countygroup	Countygroup	Countygroup	State X Year

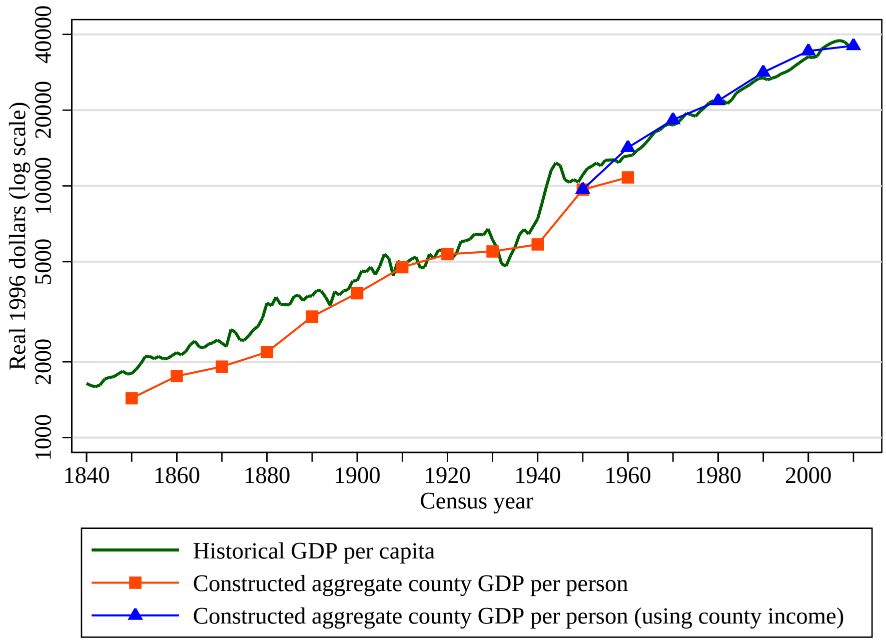
Notes: This table shows a number of robustness variations on our main specification in Table 2. The first three columns show the effect of depreciating *Origin GDP* at different rates: 0.2% per year, our standard 0.5% per year, and a high 1.0% per year. The fourth column interacts all variables with an indicator for the fraction of counties in a county group that contain a Metropolitan Statistical Area using the most recent definition. The fifth column interacts the variables with an indicator that is 1 after 1940 and zero before. Splitting the sample at 1920 produces nearly identical results. The sixth column includes ancestry-weighted origin Gini. The last column clusters at the state-year level.

Figure A-1: Total US ancestry and ethnicity



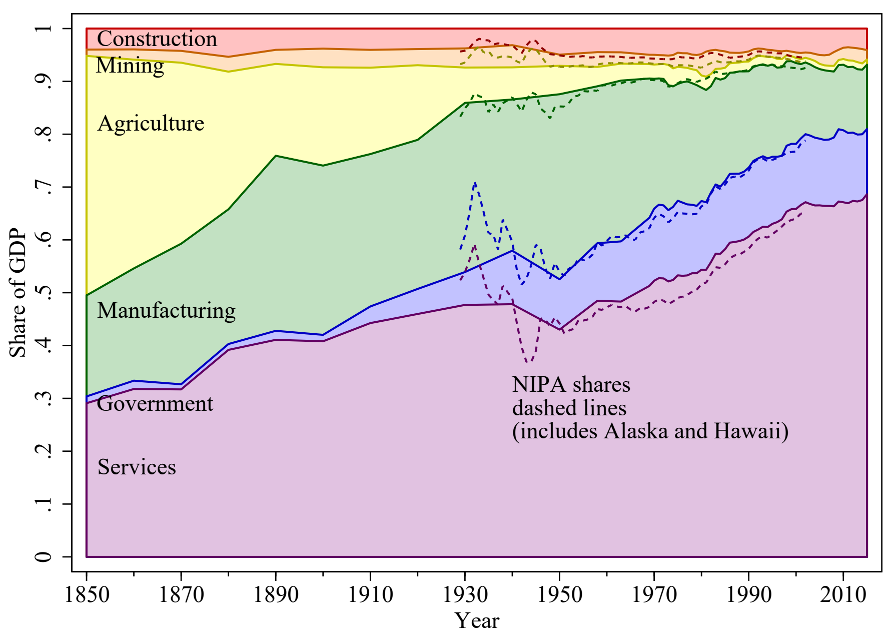
Notes: This figure shows the relationship between between our measure of ancestry and self-reported ethnicity/ancestry in the 2000 US census for the full US population. The ancestries in the upper left are ancestries such as "Southern Europe, Not Specified." For self-reported ancestry/ethnicity, England includes self-identified "American" ethnicities.

Figure A-2: GDP and aggregate county GDP per capita: 1840-2014



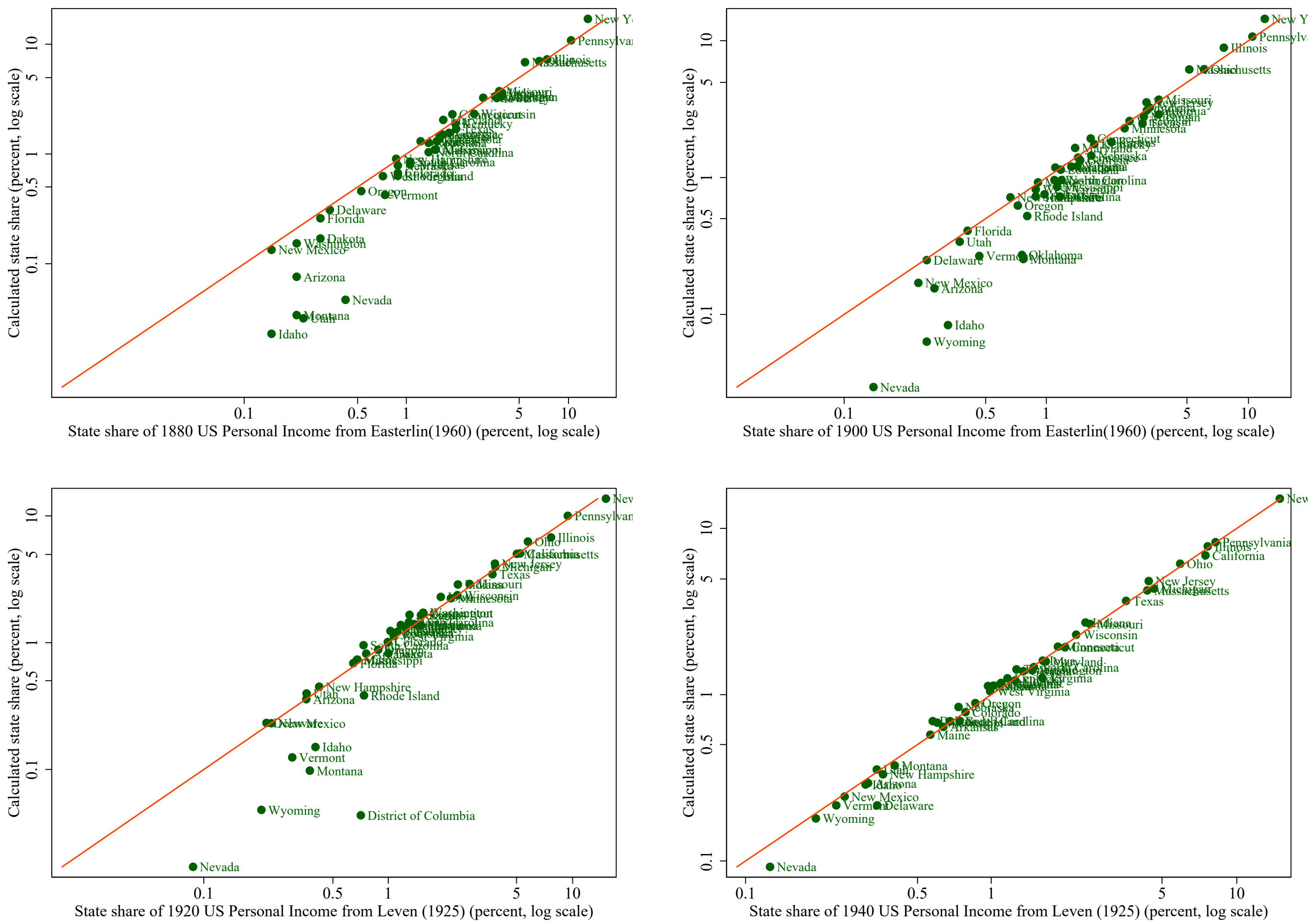
Notes: This figure shows the relationship between our calculation of US GDP per person constructed by aggregating our county group measures and historical GDP per capita from Sutch (2006). The constructed aggregate GDP per capita and aggregate county income per capita are created by totaling the county measures for each year then dividing by population. Our measure never includes Alaska or Hawaii.

Figure A-3: Sectoral shares of GDP and aggregate county GDP: 1850-2014



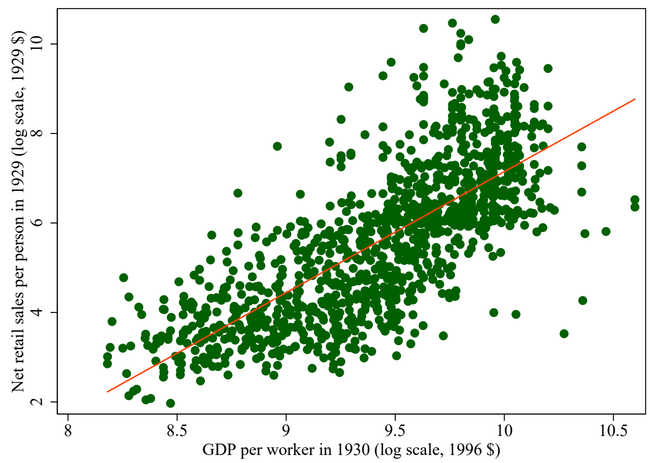
Notes: The solid lines are the national share of US GDP by sector from aggregating county groups (excluding Hawaii and Alaska). The dashed lines show the National Income and Product (NIPA), which start in 1929, from Carter (2006).

Figure A-4: State GDP and State Income Estimates in 1880, 1900, 1920, and 1940



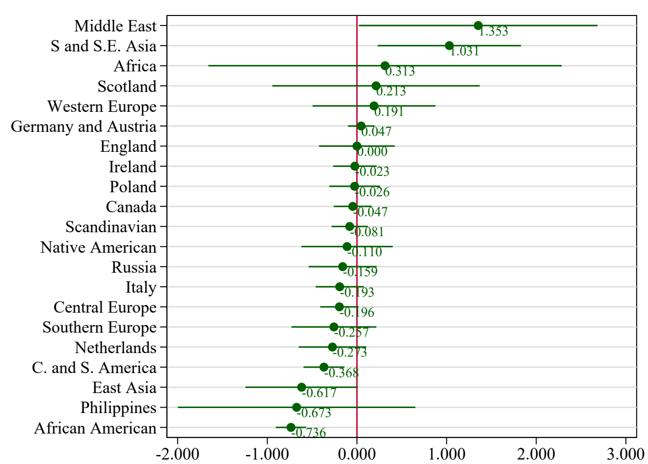
Notes: Each figure shows the state share of total US GDP from aggregating our county estimates and the state share of total US personal income from estimates by Easterlin (1960), Schwartz and Robert E. Graham (1956), and Leven (1925).

Figure A-5: County GDP per worker and net retail sales per person in 1929



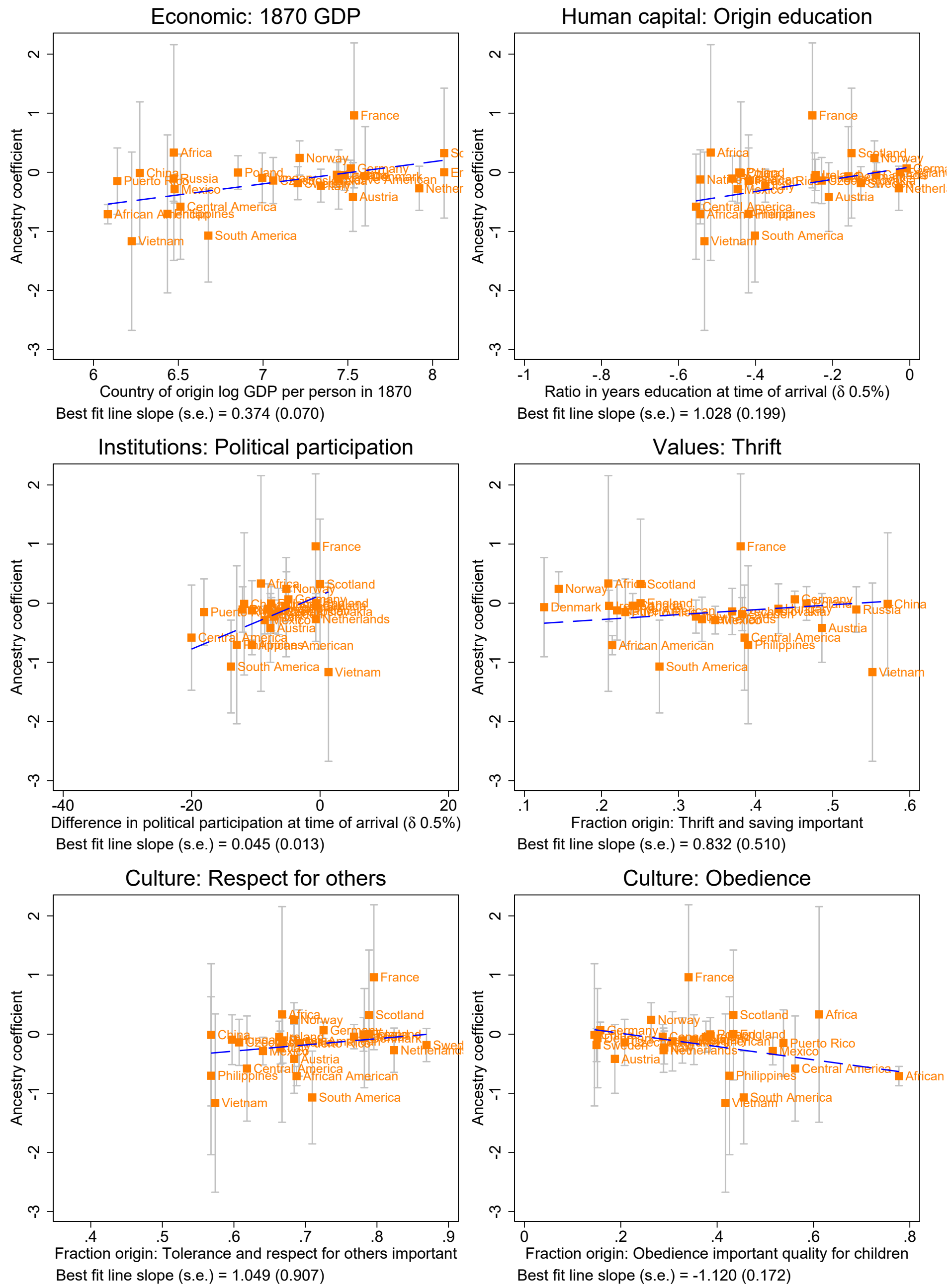
Notes and sourcces: Net Sales of Retail Distribution Stores, 1929 from Minnesota Population Center (2011). Best fit line by county, not weighted by size.

Figure A-6: Grouped ancestry coefficients



Notes: This figure shows effects on log county GDP per person for combined ancestry groups (bars represent 95% confidence intervals). Combined groups exclude larger origins, such as Italy, which are included separately. The excluded group is England, which has an implied coefficient of 0 and the standard error of the constant. The regression includes two lags of log county GDP and division by year fixed effects and matches Table 1 column 5.

Figure A-7: Ancestry and other endowments from the country of origin



Notes: This figure shows the relationship between variables in the country of origin and the coefficients estimated for large ancestry groups in equation 1 estimated in column 5 in Table 1. The equation for log county GDP per worker includes county group fixed effects, census division X year effects, and two lags of county GDP per worker. Each country of origin measure is constructed as the immigrant arrival weighted density of that country. See Appendix C for sources and calculation of arrival density. Origin education is the ratio of years of education in the origin country and in the US at the time of arrival. Years of education are from van Leeuwen and van Leeuwen-Li (2013). Constraints on the executive are described in Appendix D.4. Political participation is the percent that could vote in national elections (Vanhanen, 2012), taken as the difference between each country and the US political participation, weighted by the time of arrival with a depreciation rate of 0.5%.