The Effect of Land Allotment on Native American Households During the Assimilation Era

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Abstract

Between 1906 and 1924, the U.S. government broke up millions of acres of communally owned reservation lands under the authority of the Dawes and Burke Acts, and allotted them to individual Native American households. We study the effects of this policy on the affected households. We exploit quasi-random variation at the extensive and intensive margin of being given land, as well as in the legal title to that land. We interact these treatments with household characteristics as well as with ethnographic measures of ancestral tribal norms related to private property and female bargaining power in the household, and with measures of the scale of tribes’ subsistence activities. We trace the affected Native American households in the 1930 and 1940 U.S. Census and study the effects of allotment on their wealth, occupation and income, intermarriage with non-Natives, and their sons’ volunteering to fight in WWII.

Keywords: TBA JEL Codes: TBA

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1 Introduction

Native American reservations were formed in the U.S. in the second half of the 19th century. By the beginning of the 20th century, with the end of the Indian Wars and the closing of the frontier, the U.S. government turned its attention to assimilating Native Americans into wider society, and to turning them into citizens. Land allotment was a major component of this strategy. Indian allotment had theoretically started with the passing of the Dawes Act in 1887. However, very little land was allotted for the twenty years after the Act’s passing, and Indian allotment only began in earnest with the Burke Act in 1906. A major motive of the Burke Acts was to provide a path towards citizenship coupled with landownership. All Indian allotments were first placed in a trust managed by the Bureau of Indian Affairs (BIA) local superintendents (the Indian Agents). In-trust status limited allottees’ title to the land and prevented them from selling. Following the trust period, allottees who were declared “competent” were eligible to convert their trust land to fee-simple, and coupled with this at the same time become citizens.\footnote{Another motive (which may well have been the primary motive for many) was to free up the left-over surplus tribal land for white settlement.} By the early 1820s, this system came under increasing scrutiny. On the one hand, there were worries that the system was liable to abuse, and that Native Americans who had their land transferred into fee simple were liable to then sell it under value. On the other hand, there were increasing calls to extend U.S. citizenship to all Native Americans irrespective of land title. In 1924, at the height of the process of allotment, the Indian Citizenship Act extended citizenship to all Native Americans, which abruptly throttled both the process of allotment and of transfers into fee simple. After 1924, allotments and transfers slowed to a trickle and in 1934 they ended entirely with the passing of the Indian Reorganization (or ‘Howard-Wheeler’) Act (IRA). This paper studies the consequences of this period of reallocation from communal- into individual-level land-ownership for the affected households.

We begin by showing in Figure 1 the margins of variation that we utilize in this paper: (1) The first column shows the margins of treatment: extensive (allotment/not), intensive (size, date of allotment), and whether allotted land is held in trust or with full legal title in fee-simple. (2) The second column lists sources of plausibly exogenous variation: one of these is the overall timing of allotment across reservations. Reservations had to be surveyed and parceled in order to be allot-
Notes: This figure presents the taxonomy of our research agenda, divided into four margins of variation: (1) the margins of defining our treatment, (2) sources of plausibly exogenous variation, (3) variables with which we intend to interact treatment, (4) outcomes that we will consider.

Table 1: Taxonomy of Research Agenda

<table>
<thead>
<tr>
<th>(1) Treatment</th>
<th>(2) Exogenous Treatment Variation</th>
<th>(3) Interactions</th>
<th>(4) Outcomes</th>
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<tr>
<td>- Allotment</td>
<td>2. Agent Productivity</td>
<td>2. Ethnographic Atlas</td>
<td>2. Intermarriage</td>
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<tr>
<td>- Size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Trust to Fee</td>
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ted and this introduced a strongly sequential pattern into when allotted reservations were allotted. Because of the subsequent trust-window during which Indian allotments were held in trust before being transferred into fee simple, the 1934 IRA meant that individuals on later-allotted reservations never obtained fee-simple title to their land. The second source of exogenous variation is based on exogenous turnover in the BIA’s Indian Agents. Indian agents were exogenously rotated every four years, and they varied a lot in the application of their discretionary powers of transferring land from trust-status to fee simple. An individual Native American whose allotment was in principle approaching eligibility for transfer into fee-simple may have bumped up against an agent unwilling to process this transfer. (3) The third column lists variables with which we intend to interact treatment: These are allottees’ blood quantum (i.e. full, one-quarter+, one-quarter−), allottee’s age, the household structure at the time of allotment, and their tribes’s ancestral ethnographic norms surrounding private property. Such norms have been quantified and coded on the Ethnographic Atlas (EA). (4) The fourth column lists outcomes that we are interested in: These are wealth, income, and occupation variables in the 1930 and 1940 Census, intermarriage with non-Native Americans. A major aim of Indian allotment was also the cultural integration or colonization of Native cultures into mainstream American society. Because of this, a further outcome of interest is the (sons of) allottees propensity to volunteer to fight for their country in WWII.

The basic structure of our data is as follows: From the Bureau of Land Management (BLM), we have the universe of all land allotments to Native American households, including their date, size...
in acres) and geo-referenced location down to the 640-acre Public Land Surveillance System (PLSS) section. If the land was transferred into fee-simple, we have the date of this occurrence. Close to 180,000 individual Native American were allotted land between 1887–1934 in this data. At the extensive margin (being allotted land or not), there was sharp variation across reservations: Only roughly half of all reservations were allotted. Amongst the allotted reservations, practically the entire eligible population received allotments. There was, however, substantial ‘intensive margin’ variation in the subsequent transfer of this allotted land into fee-simple status within reservations. From the BLM data, we thus have the universe of ‘treated’ Native American households, as well as the intensive margin of their treatment. We then match these households to the US Census to study the effect of allotment on the evolution of income, property, and occupational rank between the 1930 and 1940 Full Count Censuses.

Our basic hypothesis is this: at the extensive margin (allotment/no allotment), we expect allotment to have some positive economic effects for individuals that we can find in the 1930 and 1940 census. At the intensive margin, we expect fee-simple land to have more beneficial effects on average than in-trust land, simply because it grants the owner more abilities to reap economic benefits. We expect both margins to interact significantly with the treated populations ancestral cultural norms. A growing literature on the long-run consequences of ancestral cultural norms, summarized for instance in Giuliano and Nunn (2018), suggests two interactions in particular: We expect a positive interaction (in terms of economic benefit) with norms of higher female bargaining power (EA variables on ‘mode of marriage’ and on ‘domestic organization’). And we expect a positive interaction with historical norms of private property (EA variables on ‘inheritance rules for real property’). Lastly, we expect the effect of the Dawes Act to interact significantly with the scale and connectedness of tribes’ traditional subsistence patterns, e.g. whether tribes were traditionally active in large-scale grazing or in ditch-agriculture as opposed to farming at small scale on family plots.

The core contribution of this project is to provide an identification strategy that allows us to causally identify the effect of a one-off substantial individual- or household wealth shock on long-run outcomes as a function of the cultural norms of the population under study. In this, we relate to two papers in particular. Bleakley and Ferrie (2016) study the effect of a one-off substantial
individualwealth shock on the educational attainment of the treated population’s children. The second paper is by Di Tella, Galiant, and Schargrodsky (2007), who exploit quasi-random variation among squatters in Buenos Aires to identify the effect of legal title to land on beliefs and norms related to the market. Their outcomes of focus are survey responses. We differ from both studies in our focus on cultural heterogeneity across the treated populations and furthermore from Di Tella et al. (2007) in our focus on the long-run consequences of treatment. In addition, we relate to a literature on the economic benefits of being able to collateralize one’s property (De Soto, 2000; Anderson and Lueck, 1992). The distinction between ownership of unalienable in-trust land and alienable fee-simple offers a unique opportunity to study the effect of the collateralizability of property, while holding constant security of tenure.

Our paper also relates to a number of studies on communal land-ownership and communal—or, in the Native American context, tribal—political control, as well as on land-tenure systems on reservations (Anderson and Lueck, 1992; Frye, 2012). A number of papers demonstrate that under-investment on reservations by outsiders is partly a response to the danger of opportunistic behavior by tribal courts and the resulting hold-up problems, thus implying one potential downside of tribal control if not properly managed (Anderson and Parker, 2008). There is also a number of studies that are specifically concerned with the long-run aggregate consequences of the Dawes Act for tribes and reservations as a whole. When the 1934 Wheeler-Howard Act repealed Dawes, it froze into trust lands that had been allotted but not yet transferred into fee simple. Under this Act, all descendants of the original allottees of land held in trust had an equal claim on the land, and had to agree unanimously to any activity on the land, including activities such as leasing as well as the later transfer into fee-simple. This created huge inefficiencies on the large swaths of Indian lands that had been allotted but not transferred into fee-simple before 1934. Two recent studies examine these inefficiencies quantitatively: Leonard and Parker (2017) study the effects of the coordination problems that emerge when multiple claimants need to acquiesce to a joint project on in-trust land. And Leonard, Parker, and Anderson (2018) compellingly show that the aggregative effects of undergoing allotment on the affected reservations were negative.

In the following, section 2 explains how the Dawes Act and Burke Act were implemented.

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2 Bleakley and Ferrie (2016) exploit Georgia’s Cherokee Land Lottery of 1832, in which winners received land opened up by the Jackson administration’s Indian Removal policy.
Section 3 describes the pilot data we have collected. Section 4 discusses our identification strategy. Section 5 will present the results. Section 6 will conclude.

## 2 Background

### 2.1 Land Allotment on Reservations

Following the establishment of the reservation system, American Indian reformers considered land allotment as a requisite element in the assimilation of American Indians (Otis, 2014). Congress experimented with allotment clauses in treaties governing individual reservations starting in the 1850s. These treaties formed the basis for the first general allotment acts, discussed by Congress and endorsed by the Office of Indian Affairs in the 1870s (Otis, 2014). Legislation stalled over the issues of citizenship, jurisdiction, and whether to immediately grant allotted Indians title to their land. In 1880, Senator Coke of Texas introduced a bill calling for the allotment of all reservation lands. This bill provided for the allotment of Indian lands following the designation of the president and a 2/3 majority vote in favor by the adult male members of the tribe Prucha (2014). The allocation of land varied by household type and age and allotments were inalienable for 25 years. The bill also allowed for the tribe to sell excess reservation lands to the government (Prucha, 2014). The bill found heavy support within Congress, the Office of Indian Affairs, and among reformers. The Coke bill passed in the Senate, but failed in the House due to opposition from western legislators that felt the bill was too generous to Indians (Carlson, 1981).

Henry Dawes introduced a modified allotment bill to the Senate in 1886. The bill quickly passed before moving to the House, where it passed after the addition of several amendments. On February 8, 1887, President Grover Cleveland signed the Dawes General Allotment Act into law. The Dawes Act authorized the president, through the Office of Indian Affairs, to survey and allot reservation lands deemed appropriate (Banner, 2009). Heads of household received 160 acres, single persons over 18 received 80 acres, orphans under 18 received 80 acres, and other single individuals under 18 received 40 acres. If the land was only suitable for grazing the allotment amounts doubled. If a prior treaty specified larger allotments, the prior treaty acreages were doubled. By the late 1870s, nearly seventy treaties included clauses regarding the allotment of Indian lands (Prucha, 2014).

Tribes in New York and Indian Territory were temporarily exempted from the Dawes Act.
applied. Allotments were mandatory and anyone not selecting an allotment within the first four years, would be assigned a parcel by the Indian Agent.

Once selected, allotments were approved by the Secretary of Interior and each Indian was issued a trust patent. This patent held the allotted land in trust for a trust period, during which the Indian or their heirs were the beneficiary of the allotment. Land held in trust could not be alienated or leased and was not subject to state or local taxes. At the end of trust period, the allotment would be transferred to the owner as fee-simple. Unallotted reservation land was designated as surplus and made available for outside settlement. The law required tribal approval of ceded surplus land, but tribes were rarely in a position to negotiate (Carlson, 1981).\(^5\) Proceeds from the sales of the surplus land were held in trust and appropriated at the discretion of Congress for “education and civilization” (Banner, 2009). The Dawes Act was amended in 1891 to grant 80 acres to every adult, instead of 160 acres to heads of households. It also gave the Secretary of Interior the authority to establish leasing regulations for allotted lands. Leasing agreements were managed by Indian Agents and the leasing of allotted lands was widely adopted across reservations (Carlson, 1981). Gradually the Dawes Act was amended to relax constraints on sales of trust lands. In 1903, the Office of Indian Affairs was authorized to sell allotments of deceased allottees with multiple heirs, and in 1907, they were authorized to sell allotments of original allottees under special circumstances. In 1906, the Burke Act granted the Commissioner of Indian Affairs the authority to shorten or lengthen the 25-year trust period for individual allotments. Shorter trust periods were often at the recommendation of the Indian Agent (Carlson, 1981). The Burke Act gave agents considerable authority over the process of converting land from trust status to fee-simple.

2.2 Administration on the Ground

Implementing the Dawes Act on an individual reservation was a complicated process. First, the allotting agent in charge of the reservation was tasked with determining the list of eligible tribal members entitled to an allotment and the household structure for every household within the reservation (Banner, 2009). These agents were also tasked with surveying and dividing the reservation into parcels. The agent possessed considerable authority over the assignment of allotments,\(^5\) By 1903, tribal approval was no longer necessary.
even for those eligible Indians that desired an allotment. There are numerous accounts of outside settlers influencing agents to set aside the highest quality land for surplus (Banner, 2009; Otis, 2014; Carlson, 1981). In cases where the Indian did not select a plot, the agent assigned an allotment. Each allotment was given an allotment number and a patent was filed with the Government Land Office upon approval by the President. These official patents specified the trustee, the specific plot location, the date, and the unique allotment number. Reservations were either allotted all at once or over a period of several years.

2.3 The Allotment Era

The allotment process moved quickly. On the extensive margin, nearly four reservations per year were designated for allotment over the first two decades. On the intensive margin, the government averaged nearly 4,500 allotments per year over the same period (Otis, 2014). The rapid expansion of allotment and concerns about the lack of development of Indian farmers, expansions in leasing, and sales of Indian land to settlers led to a change in public opinion regarding allotment. These concerns culminated in a review of the current social and economic conditions on reservations by Lewis Meriam of the Institute of Governmental Research in 1928. The Meriam Report, published in 1928, was critical of the support provided to Indians by the Office of Indian Affairs (Meriam, 1928). This report led to a shift in federal Indian policy, brought to fruition by President Roosevelt’s new Commissioner of Indian Affairs, John Collier. Collier introduced a bill that fundamentally changed Indian policy. In 1934, the Indian Reorganization Act (IRA) ended the allotment of Indian reservations. The IRA returned unallotted lands back to tribal ownership and froze allotted trust land in its trust status, creating a patchwork of land tenures within Indian reservations.

2.4 Legacy of the Allotment Era

In total, the government extended the Dawes Act to 118 reservations and issued over 245,000 patents covering nearly 41 million acres (Office of Indian Affairs, 1935). The policy resulted in a substantial transfer of land out of Native ownership. Prior to the Dawes Act, Indians controlled over 138 million acres of lands within their reservations. By 1934, Native land holdings had fallen to 52 million acres. Nearly 60 million acres were ceded as surplus and the remaining were sold as
fee-simple or alienated by the Secretary of Interior (Office of Indian Affairs, 1935). Within reservations, the Dawes Act created considerable variation in the status of land tenure. Often parcels of differing tenure types are adjacent to one another, creating a checkerboard pattern on reservations. Figure 2 illustrates this pattern on the Pine Ridge Reservation in 1904. Further complicating this arrangement, following the death of the original allottee, heirship of trust land was determined by state law. Over multiple generations, this process could result in complicated heirship structures that impeded development. While the aggregated effects of the Dawes Act are well documented, it is less well understood how the Dawes Act affected individuals and their families. Our paper aims to address this topic by exploring the effect of the Dawes Act on individual Native American families, by exploring the extensive margin of receiving allotments and the intensive margin of converting trust land to fee-simple.

Figure 2: Checkerboard Pattern of Land Tenure on the Pine Ridge Reservation in 1904

Notes: Image from the Pine Ridge Land Information System.
3 Data Sources

This section follows the taxonomy laid out in Figure 1.

3.1 Defining Treatment in the Allotment Data

Following approval from the President, each patent issued on the reservation was filed with Government Land Office and was digitized by the BLM. These patents record the transfer of land titles from the federal government to individuals. Each patent contains information regarding the patentee’s name, the specific location of the parcel(s), the official signature date, total acreage, and the type of patent issued. Patent types include cash sales, homestead entries, and Indian allotments. The patent also includes the Indian allotment number associated with the transaction.

A nice feature of the BLM data is that we can see exactly the date on which each patent was issued (in trust) and the date on which it transferred into fee simple, if ever. This ability to “follow individual trusts” and when they were converted to fee simple is interesting in and of itself, particularly because of the large amount of allotted land that became “trapped” in trust in 1934. The glacial process by which allotted land transferred into fee simple after 1934 is very visible in Figure 3. However, for this project, we are not really concerned with the slow post-1950 process of transferring further land into fee simple. Our focus is the ability to measure, when we observe people in the 1930 or 1940 Census, whether at that point their land had been transferred into fee simple.

3.2 Data used for Identification Strategy

We pursue two identification strategies, which we lay out in section 4.

The first identification strategy will rely on the staggered timing with which the government’s surveyors concluded the surveying and parceling of reservations lands that was a prerequisite for allotment (Gay, 1987). Individuals on reservations that were opened for allotment later on had a higher chance of being precluded from having their land transferred into fee-simple by the 1924 Indian Citizenship Act (and more so by the 1934 Indian Reorganization Act). The implementation of this strategy only uses the BLM data in section 3.1.

The second identification strategy will rely on an interaction between two terms. The first
Figure 3: Flow of Allottments and Transfers into Fee Simple

Notes: This figure tracks the flow of acres that were allotted and the flow of acres subsequently transferred into fee simple.

term is individual Indian Agents’ processing times of transferring land from in-trust to fee simple. The second term is the time-passed since an individual received their initial allotment since this determined whether this land was eligible to be transferred at all. The first term in this interaction will be measured by Indian Agent fixed effects, estimated in a panel of land transfer data. (Details in section 4.) For this we needed to construct a full panel that tells us which agents were in charge of which reservation in each year. We collected this data from the Department of Interior sections of the Official Register of the United States (United States Government Printing Office, 1932).

3.3 Interaction Terms

Aside from variation in the treatment with allotment, we are also interested in how this treatment interact with the allottees’ personal and tribal characteristics. In particular, we are interested in whether household structure at the time of allotment played a role in mediating the effects of allotment, as a large literature on household bargaining suggests it should. We are also interested in whether blood quantum mattered. We are also interested in whether ancestral tribal norms that had developed over many centuries before the formation of reservations played a role in mediating the effects of allotment, as a large literature on the importance of culture and norms
suggests it should.

### 3.3.1 Indian Census Rolls

We obtain information on household structure at the time of allotment, as well as on blood quantum, from the *Indian Census Rolls*: Starting in the mid-1880s, Indian Agents were required by law to perform an annual census of the Indian population “under their charge” (National Archives, 2018). The structure of the censuses evolved over time, and in the late-1920s the Office of Indian Affairs produced a standardized format that recorded a robust set of demographic characteristics. The *Indian Census Rolls* recorded both traditional and English names, gender, age, tribe, marital status, relationship to the household head, and the degree of Indian blood. The censuses also report unique allotment numbers for individuals that had been issued an allotment at the time of the census. Starting in the early 1930s, the censuses also recorded whether the individual was residing on the reservation, and if not, their location.

For now, we have collected the full census rolls for 13 agencies, covering 19 reservations.

<table>
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<tr>
<th>Reservation</th>
<th>Agency</th>
<th>State</th>
<th>Count Total</th>
<th>Count Allotted</th>
<th>Count Unallotted</th>
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**Notes:** Source: *Indian Census Rolls 1885-1940*. This table lists the 19 reservations in our data, their population total, and divided into their allotted and unallotted populations.
Table 1 illustrates the coverage for each reservation and the year we recorded the census. In total, our sample includes almost 50,000 individuals Figure 4 plots the reservation locations for our pilot sample. Our data covers eight western states, with varying applications of allotment. The charts next to each reservation illustrate the distribution of allotments within each reservation. Even within agency, there was considerable variation in how the Dawes Act was distributed.

**Household Variation:** While land allotments were granted to individuals, we observe substantial variation in the application of the Dawes Act within individual households. The Indian Census Rolls recorded family groups, allowing us to distinguish between allotments received at the individual level and the total allotments granted at the household level. Using the BLM data, we observe the location of each family member’s allotment within the reservation. This gives us the ability to observe the spatial separation of parcels within a household.

**Blood Quantum:** The Dawes Act did not condition allotment eligibility on the degree of Native American blood an individual possessed. Determining the list of eligible allottees was a

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Notes: Source: *Indian Census Rolls 1885-1940*. This figure locates the 19 reservations in our data, with pie-charts denoting the share of the their populations that was allotted.

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6This spatial variation is also beneficial to account for the state-level implementation of inheritance laws.
primary challenge of Indian agents (Banner, 2009). This gave equal allotments to full blooded Native Americans and individuals of mixed race. The Indian Census Rolls recorded the blood quantum, the fraction of Indian blood, for each individual in the dataset. This variation will allow us to examine the role of ethnicity in determining the effects of the Dawes Act.

### 3.3.2 Ethnographic Variation

An additional source of variation comes from the Murdock (1967) *Ethnographic Atlas* (EA). The EA has tribal information on property rights norms, marriage and domestic organization, and inheritance customs. The following is a rough sketch of the EA variables that lend themselves to being used in our analysis:

- Information on property rights norms is contained in EA variables 74–77 on ‘Inheritance Rule for Real Property’ (Land)
- *EA* variable 7 ‘Mode of Marriage’; recently used in Giuliano and Nunn (2018)
- *EA* variable 8 ‘Domestic Organization’, as well as 10–11 on Marital Norms
- We may also look at the variables for ‘endogamy’, i.e the custom of marrying only within the limits of a local community or clan

### 3.4 Measuring Outcomes in the Population Census

The so-called “rule of 72” dictates that non-anonymized individual-level Census information can be made available 72 years after a Census was published. This implies we currently have access to the 1920, 1930, and 1940 Full-Count US Census volumes. Each of these include around 300,000 individual Native Americans living in roughly 80,000 households (with some intermarriage). In these Census volumes, we can measure changes in the evolution of individuals’ per capita incomes, their occupational rank and property ownership across.

The big practical challenge lies in linking these historical records jh (3.4.1) between Census waves and (3.4.2) from the BLM data to the Census. (By contrast, the BLM data and the *Indian Census Rolls*, which were distinct from the *Census of Population*, are precisely matched in the tuple of reservation and allotment number.) Record linkage of large historical datasets is an extremely
active area of research of economic history. Older record linkage methods used a smaller number of variables for matching, and often used name only, often focusing on samples of people with unusual names in order to reduce false positive matches, e.g. Ferrie (1996). Matching on names is almost always fuzzy matching, i.e. a matching algorithm that allows for typos and mis-spellings. A common approach involves splitting first and last names into substrings (‘bigrams’), and to construct a similarity index over all bigrams. A commonly used similarity index is to calculate the ‘Jaro Winkler index’ between two names. Newer iterations of fuzzy matching have increased the flexibility to include matching on a set of numeric as well as string variables, including distance calipers on numeric variables, e.g. giving a higher match probability when two records’ birth-years are one year rather than three years apart. See Abramitzky, Boustan, and Eriksson (2012, 2016) for more recent applications. Recently, the emergence of machine learning algorithm has given a real boost to the precision of record linkage methods, as it allows for training an algorithm. See for example the method outlined in Feigenbaum (2016).

Linking Native Americans across historical records is both easier and harder than linking other populations. On the one hand, the more unusual names that Native Americans typically have make it in principal easier to uniquely track individuals across historical records based on only name and a few more characteristics like age and birthplace. In addition, the majority of Native Americans in the 1930s and 1940 lived on or near their reservation so that location is a more powerful linkage variable than in the overall population. On the other hand, the more unusual names also meant that Census enumerators made more frequent errors in recording names. It turns out that these specific features make machine learning even more useful in our case than they ordinarily are for record linkage.

3.4.1 Matching Census Waves 1910–1940

In each Census wave we observe first name, last name, birthplace and birthyear. Other variable that should not change too much and therefore make good matching variables are ‘language spoken in the household’ and ‘county of residence’. The language spoken variable is, however,
relatively thinly reported, and ‘county of residence’ cannot be given too much weight since there was some migration over the ten years separating census waves.

The main challenge is that the reported names were measured with a lot of names. Individual often gave a less anglicized version of their name in 1930 than they did ten years later. In addition, Census enumerators often made spelling mistakes with the many more unusual names.

Our approach is to use STATA’s `dtalink` package, which provides a lot of ability to fine-tune the matching algorithm, e.g. giving more weight to rare names. We run the matching algorithm separately for nine BIA regions, ad fine-tune it separately to each region. BIA regions roughly correspond to distinct Native Americans cultural areas. These differences matter primarily because the distinctiveness of Native American names varies a lot by tribes. The Navajo in Arizona have names that are very distinct from American names. By contrast, names among tribal members of the ‘Five Civilized Tribes’ in Oklahoma were already heavily anglicized by 1930. As a result, names should receive less weight in matching in Oklahoma than they do in Arizona.

In step 2, we then built a training set by having research assistants go over a ten-percent random sample of the the initial set of potential matches and determine for each set which match (if any) is the true one.

In step 3, `dtalink` then crucially has the ability to learn from this training data, and to update the matching-weights given to different variables.

### 3.4.2 Matching the BLM Data to the Census

The issues with matching the BLM Data to the Census are similar to those with matching Census waves to each other. The main difference is that we do not observe age in the BLM data, except for the subset of all allottees that we have matched to the *Indian Census Rolls* via their allotment numbers.

### 3.4.3 Defining Control Groups

One additional issue that we need to deal with is that tribe is not reported in the Full Count U.S. Census. This is problematic since one of our main interests is in interactions between the treatment of land allotment and the tribe-level measures from the *Ethnographic Atlas* (EA). To solve this problem, we combine the BLM data and the *Indian Census Rolls* to create a training dataset that
predicts tribe based on individuals’ name and location. For this purpose we are prioritizing the collection of the Indian Census Rolls for reservations that were un-allotted: Since the BLM data gives us the universe of the treated population, we need the Indian Census Rolls to generate a near-universe of the untreated. We then apply the machine learning algorithm developed in Dippel and Heblich (2018) to predict ancestry among soldiers in the Union Army from 1861–1865 based on reported ancestry in the 1860 Full Count Census. This algorithm then predicts a tribal affiliation for every Native American in the Census to which we can map the EA’s tribal characteristics.

3.5 World War II Enlistments

An additional set of outcomes come from World War II enlistment records. A conjecture one might have is that allotment, to the extent that it integrated allottees into the off-reservation U.S. economy, may have also induced the sons of allottees to enlist to fight for the U.S. in WW II.

4 Estimation-Framework

We pursue two identification strategies, one based on the timing of a reservation’s initial allotment window, and one based on the exogenous rotation of individual Indian Agents.

Identification Based on Initial Allotment Timing: The first identification strategy will rely on the staggered timing with which the government’s surveyors concluded the surveying and parceling of reservations lands that was a prerequisite for allotment (Gay, 1987). Within each allotted reservation, 90 percent of allotments occurred within a narrow time-window of 3-4 years. This land could be transferred into fee simple only after a certain ‘trust period’. This process of transferring land into fee simple was slowed dramatically after the passing of the 1924 Indian Citizenship Act and came to a complete stop with the 1934 Indian Reorganization Act. This meant that individuals on reservations that were opened for allotment later on had a much higher chance of being precluded from having their land transferred into fee-simple because they only became eligible for this transfer after 1924 or after 1934. The implementation of this strategy only uses the BLM data in section 3.1.

[FIGURE Added Here to Show the Sequential Nature of when the 118 Allotted Reservations
Identification Based on the Rotation of Indian Agents: The second identification strategy will rely on the fact that even for individuals who became eligible for transferring their land into fee-simple before 1924/1934, the chances of this happening depended critically on the individual Indian Agents in charge of a reservation at the time. Not only did agents differ in the speed with which they transferred land into fee simple, they were also exogenously rotated across reservations on four-year cycles. To operationalize this insight into an identification framework we use the Official Register of the United States (United States Government Printing Office, 1932) to build a reservation-agent panel that tells us which agents were in charge of which reservation in each year.

Let $i$ denote both an allotment and an allottee, disregarding for the moment the fact that a few allottees received more than one allotment, e.g. because of inheritance. We then define a dummy $D_{i(r)t}$ if allotment $i$ tied to reservation $r$ was transferred into fee simple in year $t$. We regress this dummy on time passed since $i$ was initially allotted in some year $\tau$, as well as on a full set of reservation fixed effects $\pi_r$ and year fixed effects $\pi_t$, and finally a full set of agent fixed effects $\pi_a$, where each agent is uniquely mapped to one reservation in a given year. These fixed effects then form the basis of an instrument. The variable to be instrumented is a dummy $D_{i(r)}$ for whether $i$’s allotment was transferred into fee simple by the time we observe $i$ in the Census. The first stage regresses $D_{i(r)}$ on the agent fixed effects $\pi_a$ of all agents that were in charge of $i$’s reservation between the year of $i$’s initial allotment and the year we observe $i$ in the Census. Furthermore, these fixed effects are pre-multiplied by either a dummy $e_{it} = 1$ for years $t$ in which $i$ was eligible for transfer into fee simple, or otherwise by a dummy $ne_{it} = 1$ for years $t$ in which $i$ was not eligible for transfer into fee simple. This dummy $ne_{it}$ can also be broken into up to three dummies $\{ne_{it}^1, ne_{it}^2, ne_{it}^3\}$ denoting periods when (1) allotment $i$ was (1) not yet eligible for transfer because the trust window was still in place, when (2) $i$ was unlikely to be transferred because $1924 < t < 1934$, or (3) when it was impossible for $i$ to be transferred because $t > 1934$. Agent fixed effects that are pre-multiplied by $ne_{it}$ or any of $\{ne_{it}^1, ne_{it}^2, ne_{it}^3\}$ should have

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9 Although this is unlikely to make much difference, we should in principle re-estimate the agent fixed effects for each allottee $i$ separately, omitting $i$’s allotment from the estimation of the fixed effects which we use in the second stage as an instrument for whether allotment $i$ ended up being transferred into fee simple.
no explanatory power in the first stage.

5 Results

TBA

6 Conclusion

TBA

References


