Online Appendix

A Model Details and Proofs

This section mathematically describes and solves a model comparing owner operation to tenancy. Building off the static framework in Banerjee, Gertler and Ghatak (2002), it adds investment and resale to study long-term effects.

A.1 Static Problem

The world consists of a parcel of land, its owner, and its operator who may or may not be distinct. Owners may engage in low-intensity agriculture on unimproved ($I = 0$) land, which always produces an output of 1. Alternatively, they may engage in high-intensity agriculture on improved ($I = 1$) land. In this case, output is stochastic at $Y = A > 1$ in the case of success and is $Y = 0$ in the case of project failure. The probability of success is equal to the effort e of the operator. Owners[1] of $I = 0$ land may improve it to $I = 1$ for a cost $r > 0$. Effort and investment are costly to the operator and owner, respectively. Qualitatively, the $I = 0$ case corresponds to low-intensity uses like ranching whereas $I = 1$ corresponds to high-intensity uses like crop production.

Landowners come in two types. Small-scale owners S operate their own parcel and choose their level of investment and effort, as in the design for Homestead ownership. For high-intensity ($I = 1$) agriculture, large-scale owners L must contract with a tenant. Here, effort is unobservable, so owners of improved land are limited to offering payments based on project success or failure. Owners face a limited liability constraint based on tenants' ability to pay upfront. The contract must also offer tenants at least as much utility as their outside option, which I set to 0. All agents are risk neutral.

Effort costs the operator a monetary equivalent of $\frac{1}{2}ce^2$ and is not observable to other agents. Therefore, owners of improved land are limited to offering payments of l in a low state and h in a high state. Tenants have access to resources W which determines the limited liability constraint: $l, h \geq -W$. This situation corresponds to that of railroad owners who rented land. As discussed below, when tenants have a limited ability to pay (low W), landlords will often be constrained to offer share contracts; in the case of crop failure, fixed ("cash") rent cannot be extracted. The non-intense $I = 0$ land use similarly avoids crop share contracts, reflecting a non-crop usage.

Up to this point, the $I = 1$ case is equivalent[2] to the model in Banerjee, Gertler and Ghatak (2002) and the landlord's constrained optimization thus has the same solutions:

[1] With minor adjustments, the basic results still hold if these costs are borne by the operator.

[2] A minor difference is that here the outside option is normalized to 0, but in general the sum of the outside option and limited liability values together form a sufficient statistic, so this has little effect. As in their model, I focus on the case where c is large enough to guarantee proper probabilities of success in equilibrium and ignore the cases where the solutions are constrained by probabilities being ≤ 1.

$$(l, h-l, e) = \begin{cases} (-W, \frac{A}{2}, \frac{A}{2c}) & \text{if } W \leq \frac{1}{8}\frac{A^2}{c}, \\ (-W, \sqrt{2cW}, \sqrt{\frac{2W}{c}}) & \text{if } \frac{1}{8}\frac{A^2}{c} < W < \frac{1}{2}\frac{A^2}{c}, \\ (-\frac{1}{2}\frac{A^2}{c}, A, \frac{A}{c}) & \text{if } W \geq \frac{1}{2}\frac{A^2}{c} \end{cases} \tag{1}$$

where I have written the solution as the tenant's payment in the low state (l) and the extra payment in case of the high state ($h-l$) for ease of explication. $e = \frac{h-l}{c}$ solves for optimal tenant effort based on the first order conditions. The three cases respectively correspond to those where only the limited liability binds; where both limited liability and the outside option bind; and where only the outside option binds.

Note owner-operators always achieve first-best (surplus maximizing) effort at $\frac{A}{c}$, corresponding to the last case above. In the other two cases, effort and total surplus are below the maximum for the $I = 1$ case. This derives from the fact that in the third case, tenants receive the full value of success in their contract ($h - l = A$) whereas they receive less in the other two, bottoming out at 50% in the first case. Qualitatively, the third case can thus be considered a cash rent scenario where tenants pay a fixed fee but receive the full value of agricultural production. The other two cases correspond to different versions of share contracts, with tenants receiving only part of the return on their effort.

A.2 One-period Investment Return

In the static version of the model, S and L type owners can face different returns on investment. Because of this, the derivations from hereon out depart from the effort-only focus of classic principal agent theories as in Marshall (1890); Banerjee, Gertler and Ghatak (2002). Denote by R_S, R_L the one-period net output[3] of improved land. For the L types, this equals $W + \frac{A^2}{4c}$; $W + (A\sqrt{\frac{2W}{c}} - \frac{2W}{c})$; and $\frac{1}{2}\frac{A^2}{c}$ in the three cases above. For S types, the return is always equal to R_L's value in the third case.

Lemma A.1. *$R_L \leq R_S$ with equality only in the third case*

Proof. L-type's total returns are increasing in W and so highest in the third case. Since the tenant's outside option is 0, $R_L = R_S$ in that situation. □

Lemma A.1 shows that small-scale owners receive a weakly higher one-period payout from investment with equality only in the "cash rent" case.

A.3 Dynamic Problem

I now describe the multi-period aspect of the model. At $t = 0$, the parcel is initially allocated to either an S- or L-type owner with $I = 0$, reflecting Homestead and railroad distributions of frontier land. At the start of a new period, the previous owner sells the parcel and exits the model along with the operator. The landowner makes a take-it-or-leave-it offer to an agent of either type. S types, however, face stochastic costs in purchasing, reflecting their

[3] i.e., the monetary equivalent of owning production technology for one period, equal to the expected value of output minus any effort costs.

lack of access to capital.[4] The costs are distributed according to F_S. After transaction costs are determined and a sale occurs, improved land has a $0 < \delta < 1$ chance of depreciating into unimproved. Owners discount across periods at a rate of $0 < \beta < 1$.

The parameters above determine the sale prices for improved and unimproved land, p_0 and p_1. Since agents cannot foresee shocks at the time of their investment and contracting decisions, these values are fixed in each period. Finally, note that this implies that the only relevant state variable for each period.[5]

Lemma A.2. *If an L type improves land, an S type will also improve land*

Proof. From above, the one-period net output from improvement $R_S \geq R_L$. The cost r and expected land prices p_0, p_1 are the same and agents are risk neutral. □

Lemma A.2 shows that small-scale owners are weakly more likely to invest in unimproved land. For the remainder of the model description, I highlight the case without equality where S types improve land with $I = 0$ and L types do not. The case where the two types behave identically is simpler: since I is the only relevant state variable, initial ownership has no effect for $t \geq 1$. The two types can behave identically, for example, because W is high and cash rent is possible or because A is sufficiently low enough that neither type invests.

A.4 Equilibrium Characterization and Markovian Convergence

With I as the only model state variable, the dynamics simplify to a Markov chain on a 2×2 matrix. The probabilities $q_0 = p(I_t = 1 | I_{t-1} = 0)$ and $q_1 = p(I(t) = 1 | I_{t-1} = 1)$ completely determine the dynamics. Then, for an agent of type j, denote by $V_{j,i}$ the willingness to pay for land given $I = i$ and after depreciation and transaction costs are paid.[6]

$$V_{0,j} = \max\left(1 + \beta p_0, R_j - r + \beta p_1\right) \tag{2}$$
$$V_{1,j} = R_j + \beta p_1 \tag{3}$$

Lemma A.3. *Relative to the case where $I_{t-1} = 0$, when $I_{t-1} = 1$, period t has a weakly higher probability of S-type ownership and a weakly higher probability that $I_t = 1$ ($q_1 \geq q_0$)*

Proof. It suffices to compare the increased relative valuations $V_{i,j}$ $I = 1$ and $I = 0$ cases: $V_{1,S} - V_{0,S} \geq V_{1,L} - V_{0,L}$. Note that $V_{1,i} - V_{0,i} \leq r$ with equality when j improves unimproved land. Hence, if type S improves land (the non-trivial case for the whole model), the inequality holds because the difference is at its maximum. If type S does not improve land, neither does type L (Lemma A.2) and the differences are $R_j - 1 + \beta(p_1 - p_0)$. In this case, the

[4] Other interpretations give the same or similar results, for example, the costs of reallocation across different owners. While the homogeneity of agents within type is artificial, essentially the same results would apply under a more realistic matching process given that S types continue to value improved land relatively more than L types.

[5] Considering the end of the period to be just after the investment decision is made but before the shocks for output, depreciation, and capital costs are realized.

[6] That is, the expected value an agent expects from the land at the start of the contracting and investment phase. This is related to, but distinct from, their willingness to pay prior to these shocks.

inequality holds due to Lemma A.1. This establishes that S has a weakly higher valuation in the case of no depreciation or transaction costs.

Next, consider actual willingness to pay at the time of the sale. An agent of type j is willing to pay $(1-\delta)(V_{1,j} - V_{0,j})$ more for improved land than unimproved land. That is, depreciation attenuates the differences and transaction costs do not enter the relative difference as they are fixed. By the above, S types will pay a weakly higher premium for improved land and so are weakly more likely to purchase when $I = 1$.

Finally, note that for improved land to be unimproved in the next period, it must first depreciate. Even in that case, it is still weakly more likely to have an S-type owner (previous paragraphs) which in turn is weakly more likely to improve (Lemma A.2). $\square$

Lemma A.3 establishes persistence: land initially owned by an S-type is weakly more likely to be improved and be held under S-type ownership in any future period, with equality holding in some cases.[7] However, when $0 < q_0 < 1$, the dynamics over time are given by the transition matrix

$$T = \begin{bmatrix} 1-q_0 & q_0 \\ 1-q_1 & q_1 \end{bmatrix}$$

which is irreducible and aperiodic, meaning convergence as $t = \infty$ to the same probabilistic distribution of investments regardless of initial S-type (with investment) or L-type (with no investment) states. Appendix Figure A.10 gives specific parameter values for such a case to illustrate the convergence. Under different conditions, absorbing states are possible, e.g., if neither type invests or if L types do not invest and have a 100% probability of purchasing $I = 0$ land.

A.5 Discussion and Predictions

In the non-trivial cases, the model predicts that higher land concentration in $t = 0$ reduces investment and increases future rates of land concentration, albeit increasingly less over time. This can be seen in ‘of Table 3/Figure 3 (investment with attenuation) and Figure 5 (concentration with attenuation). However, when cash rent is possible or both types avoid investing, convergence is trivial. Empirically, Figure 4 shows that there are few effects from land concentration when cash rent is common. Convergence is also trivial when A is sufficiently low that neither group prefers to invest. Appendix Table A.4 similarly shows that there are few effects in areas with very low land quality.

[7] e.g., if S and L types have identical investment behavior or F_S is distributed such that only one type or other always purchases.

B Data Sources and Sample Construction

B.1 Property Tax Assessments

Florida and Montana property taxes are publicly available as GIS files (Montana State Library and Montana Department of Revenue, 2017; Florida Department of Revenue, 2017). I obtained Kansas, Oregon, and Wyoming taxes through either state- or county-level tax officials (Wyoming Department of Revenue and Wyoming County Assessors, 2017). For Nebraska, I webscraped county-level data hosted by GIS Workshop, covering almost all counties (Nebraska County Assessors, 2017). A large majority of assessments list the PLSS section (or, rarely, sections) of each property. In counties where section information was not comprehensively provided, I relied on GIS parcel maps (Florida, Wyoming) (Kansas Department of Revenue, 2017) or geocoded property address (Kansas) (Smith, 2025).

Some data are only reported comprehensively for specific states. Land use data including active grassland and pasturing are reported for Kansas, Montana, and Nebraska. Florida, Nebraska, Kansas, and Oregon report owner name and address. Similar data are reported partially for Montana and Wyoming, but both contain substantial unsettled lands in the public domain which are coded as owned by the federal government. These lands are typically leased to nearby farmers, meaning that ownership data has a different interpretation in these parcels compared to parcels outside the public domain. For thirteen counties in the sample, exempt government lands are absent in the dataset and for these I the CropScape-derived use value in place of total valuation.

B.2 Grant Boundaries and Sample Construction

As noted in Section 2.2, most railroad grant areas are within a pre-specified distance of the company's railroad track. For these areas, I use historical maps to find the relevant radius for the grant and draw a buffer around the railroad. In some cases, multiple effective distances applied, e.g., because companies were granted additional "miles" on some sections to substitute for excluded land elsewhere. In such cases, I choose the outermost distance as relevant. Since most railroad locations have not changed, I use modern-day GIS information from ESRI on their location as it is most precise. I confirm the grant railroad location with the 1890 railroad data from Donaldson and Hornbeck (2016).

Some grants had non-formulaic borders. For example, companies lost land that intersected with the Crow (Montana) and Osage (Kansas) reservations. In these cases, I use a mix of historical maps, court records, and Bureau of Land Management (BLM) transfer records to determine the boundaries of the grant. Maps show the rough locations of non-formulaic grants and the BLM records permit an exact mapping through the evidence of checkerboard patterns around individual PLSS Sections given by (Bureau of Land Management and U.S. Geological Survey, 2025). In the rare cases these records are incomplete, I use the BLM Tractbooks to determine the areas railroads received grants. Using the land grant boundary lines I construct, I code any PLSS section which intersects them as being within the grant area. As noted in Section 7.3, only pure formulaic boundaries are considered as part of the RD. Borders from other political boundaries, railroad start and end points, or formula violations are not considered.

B.3 Historic Farm Microdata

For farm ownership and operational details, I draw upon 1940 "county census" documents for Kansas, preserved by Ancestry and the Kansas State Historical Society (Kansas State Board of Agriculture, 1940). These were used to produce (bi)annual reports on agricultural activity by the Kansas State Board of Agriculture. For each farm in 1940, the records list the operator, the PLSS section, acreage, land use, and owner information. I selected geographic coverage based both upon the presence of railroad grant land and the existence of complete records at the district level. In the long survey, some assessors chose to leave ownership blank entirely or selectively and are excluded from the analysis. Since assessors were given fixed townships, this exclusion is mechanically balanced across even and odd sections and unlikely to lead to bias.

I also include 1965 "personal assessments" from Lincoln County, Nebraska (Lincoln County County Assessor, 1965). These are essentially tax filings based on personal property and, crucially, grain production. For the purposes of this project, they include a property's location, the owner's farm equipment used on it, and a breakdown of grain output by "operator" and "landlord" shares while giving the identity of both in this case. While some respondents record a contract without a share arrangement, this is uncommon meaning the survey primarily measures share tenancy.

B.4 Land Transfer Records

I measure land concentration and sale volume with two data sources. First, the Bureau of Land Management General Land Office records offers complete coverage of initial federal transfers (Bureau of Land Management, 2018). To the best of my knowledge, no comprehensive database of railroad transfers exists. I thus supplement these records with archival work on railroad company transfers in Lincoln County, Nebraska (Lincoln County Recorder of Deeds, 2017), which preserved its railroad sale deeds. Historical assessment and tax records were also useful for determining land concentration's impact on investment over time. To this end, I digitized the 1900 assessment records from Perkins County, Nebraska (Perkins County, 1900), and the 1912 assessors' records from Morrill County, Nebraska. The Morrill records additionally record the fraction of improved land and the value of improvements. Separate Morrill records give lists of candidates for local (subcounty) offices (Morrill County, 1912). Valuations were adjusted for inflation using (Federal Reserve Bank of Minneapolis, 2025).

For panel data, I digitized Register of Deeds transfer records for the 17N townships of Banner County, Nebraska available at the sixteenth section (40-acre) parcel level and Merrick County, Nebraska (Banner County Register of Deeds, 1882; Merrick County Register of Deeds, 1890). I selected these counties based on data quality, availability, and their possession of substantial portions of land inside and outside railroad grant areas.

B.5 Linking to Census Microdata

I often match property owners to the most recent US Census microdata (Ruggles et al., 2020) prior to the assessment/sale. Since property taxes typically only includes the owner's name, I lack key pieces of information common in other linking procedures such as an owner's age or birthplace. In all cases, I can make use of the property's county. In the case of the initial sales matching for Lincoln County, Nebraska I am also able to use a listed county of origin.

I first compute a name match score between the property owner and all Census individuals, considering only the first listed owner in the uncommon case of joint property. For both the first and the last name, I compute the Jaccard string similarity index, the fraction of unique bigrams in either name that are contained in both the owner and proposed match names. In the case of single-letter first names, I substitute a value of 90% if the two names begin with the same letter. Thus, "John Smith" would be considered a good although not perfect match for "J. Smith." I compute the overall name match as the average similarity between the first and last names.

The second element of the matching procedure is how to value location. In the case of the Lincoln County, Nebraska initial sales, I consider the owner's listed county of origin, state of origin, and finally Lincoln County itself. For historical property tax matching, I consider the property's county and state only since I lack information on the owner's origin. Taking the name match value given as above, I apply a 20-percentage point premium to the Census individual's score if they reside in the listed county of origin or property value's location; I apply a 10-percentage point premium to their score if they reside in the same state as the owner or owner's property respectively. The individual with the highest match score, including location premia, is my preferred match. To exclude false matches, by default I consider tied duplicate matches or those with string similarity below 75% as non-matches.

B.6 Population and Public Goods

2010 census block population data and 2000 census place files are from Manson et al. (2023). I obtain 2019 population at 30 meter by 30 meter resolution from University of Southampton et al. (2018). For historical population, I use the detailed 1940 Census "enumeration district" maps showing the location of every rural farm, school, church, and other structures (National Archives and Records Administration, 2011). The number of farmsteads serves as a good proxy for the rural population as almost all would have resided in farm buildings. I consider schools, churches, cemeteries, and community buildings as public goods. For the modern road network, I use the Federal Highway Administration's 2015 HPMS data (Federal Highway Administration, 2015). For town locations, I use both the Schmidt (2018) point file and the 2000 Census TIGERLINE place polygons.

B.7 Geographic Characteristics and Land Use

Elevation data are from the SRTM 250-meter resolution database (National Aeronautics and Space Administration (NASA) and National Geospatial-Intelligence Agency (NGA), 2000). A related database from the FAO contains the terrain slope characteristic, a key agricultural input. In the small number of areas where these data are unavailable, I impute elevation and slopes, regressing the measure on latitude and longitude in each county and using the predicted value. For river and stream length, I use data from ESRI (U.S. Geological Survey and Esri, 2010). For soil quality characteristics, I use the USDA's gSSURGO database (U.S. Department of Agriculture and Natural Resources Conservation Service, 2024). To measure soil quality's inherent crop productivity, I draw upon their "nccpi2 (all)" aggregated measure of soil productivity for different crops.

B.8 Other Data

For 1940 county agricultural data, including rates of share tenancy, I use data from Haines, Fishback and Rhode (2016).

B.9 Land Use Value Calculation

I construct a pure "use value" of land using satellite data on land use (USDA's CropScape), models of agricultural productivity (the FAO's GAEZ), and data on crop prices (Food and Agriculture Organization of the United Nations, 2014; United States Department of Agriculture, 2017).

For pixels coded for crop use, I first consider the expected crop yield according to the FAO's GAEZ data. I use the GAEZ "high input" scenario as this most accurately reflects agricultural processes in developed countries like the United States. For the small number of crops are not listed in GAEZ data, I use USDA-reported average national yields. To compute revenue, multiply by crop farmgate prices. I primarily use FAO-reported prices, but where these are missing I use USDA prices or prices from other sources.

For pasture and grassland pixels, I use the GAEZ yield for "pasture grass" as the expected yield of forage. Following Ahola (2013), I assume an average cow weight of 1000 pounds, that each cow eats 2.6% of its weight per day, and that 30% of forage is accessible. This analysis assumes, somewhat generously, that each grassland pixel is actively grazed. For non-developed, non-agricultural pixels, I assume a value of $0 in production.

Using the USDA's Commodity Cost and Returns dataset, I estimate annual production profits and convert these into net present valuations for cattle and each major US crop. I compute the profit margin as the ratio of revenue minus operating costs, hired labor, and taxes/insurance divided by revenue. About 1% of land in my sample has crops not covered therein and for those I use a 10% profit margin. I convert estimated annual profits to valuations by discounting at 5% rate, typical for assessors, and sum within section.

My final measure of use value also includes the valuation from urban areas. CropScape classifies such developed areas into "open," "low," "medium," and "high." Since valuations from this use do not come from production, they must necessarily be imputed. I regress total valuations in counties with complete information on the total amount of land in each category of development according to CropScape, combining the last two being combined as few pixels are coded as either. I include Township fixed effects and the main geographic characteristics and round the results. This procedure estimates a $12.5 million / square mile value for open development, $125 million for low development, and $300 million for medium/high. For comparison, Omaha, NE has roughly 180,000 households typically worth $200,000 (Zillow estimate) and an area of roughly 130 square miles, yielding about $277 million in value per square mile.

C Further Results

C.1 Aggregation Versus Splitting

This section delves more into the process of convergence in land concentration discussed in Section 7.3. In theory, convergence could be achieved either by splitting up larger properties or aggregating smaller properties. By tracking the ownership of individual parcels[8] over time, this section will show that the latter process is the primary driver. In this context, splitting properties was relatively rare and short-lived in both odd and even sections. This result parallels that in Bleakley and Ferrie (2014) which notes the difficulty in perfectly subdividing properties.

To measure splitting and aggregation, I compare holdings at a particular point in time t to their initial boundaries in 1882.[9] Here, a “holding” constitutes all the parcels owned by a particular entity. The extent to which an initial holding remains “unsplit” is calculated by the fraction of it held by a single owner in t. The extent to which it is aggregated is measured by the maximum fraction of a holding in t that can be traced to a single initial holding. I refer to this value as the “unmerged” amount.[10] In both cases, a value of 100% indicates no change on the relevant dimension. Lower values indicate increased merging and splitting.

Perhaps surprisingly, Appendix Figure A.11 shows that odd-section properties are rarely split into smaller pieces. Over the 65-year span of data, about 86% of the odd-numbered section parcels remain within the same 1882 property, indicating that land is mostly transferred intact to the next owner. Any splitting that occurs is typically complete by 1900, meaning that most reallocation instead happens due to parcels being combined over time. As a result, by the end period, the typical odd-numbered section property can only trace 61% of its area to a single 1882 property. This fraction shrinks over time as more land is combined into larger holdings. Since dividing large properties would have been the most direct way to reverse land concentration, its rarity points to the constraints faced by small owners in obtaining property.

C.2 Rural Density

Relatedly, perhaps the density of farms per se had positive effects on productivity. For example, farmers might have cooperated with or learned from their neighbors and odd sections do have fewer farms. However, that does not necessarily mean they had fewer neighbors. The interspersed nature of the checkerboard in fact meant that farmers on both types of section would be part of very similar communities. For example, someone living on (odd) section 23 would have had neighbors in adjacent (even) sections 22, 14, 24, and 26.

[8] “Sixteenth” sections of 40 acres each are tracked as essentially indivisible units in these data.

[9] Or to their first owner if allocated in a later year. The US government and railroad companies are treated as allocating entities and not as owners for this purpose.

[10] For example, consider an initial property with three owners in t who own 70%, 20%, and 10% respectively. The first piece would be considered 70% “unsplit,” and the other two 20% and 10% respectively. The area-weighted average would then be $0.7 \times 0.7 + 0.2 \times 0.2 + 0.1 \times 0.1 = 0.54$ unsplit. If those owners owned no additional land, each piece would be 100% “unmerged.” If a 100-acre farm in 1900 was formed from three complete properties of 70, 20, and 10 acres, it would be considered 70% unmerged and 100% unsplit.

Table A.6, Panel B examines this issue empirically. For each section, it picks a point at random and measures the modern[11] population living within 1-10 miles from that point. Using this slightly broader definition, there are almost no differences in density across even and odd sections. All estimated differences are smaller than 0.5% and only one (at 3 miles) is significant; it would indicate odd sections had a higher rather than lower density. So, although even squares had more farms operating within their boundaries, those farmers had similar numbers of total neighbors. Unless density spillovers occurred only within the artificial boundaries of PLSS squares, they cannot explain my results.

C.3 Property Rights and Conflict

Railroad owners could have invested less in their land because they felt their ownership was not secure. The slow speed of some (but not all) companies to either build their tracks or sell their land sparked "forfeiture" movements to reclaim their unsold sections. Within my sample, the detailed overview in Ellis (1946) lists movements targeting the Northern Pacific Railroad (NPRR) and Oregon/California Railroad (OCRR) companies. The others in my sample, such as the Union Pacific, were more compliant and not targeted; see Appendix Section C.5 for evidence on settlement speed. Although individual settlers were never targeted, in principle they may still have felt uncertainty ex-ante. Alston and Smith (2022) argues the NPRR's grant was uniquely troubled by this and other legal ambiguities as the company's "violations, controversies, and investigations... had no peers". Thus, the NPRR and to a lesser extent the OCRR are the grants where property rights would have been most insecure.

Two analyses indicate that these forms of insecurity do not explain my results. In Appendix Table A.8, odd sections in untargeted grants experienced slightly greater land value reductions: dropping the NPRR and OCRR from the sample modestly increases the estimates' magnitude and significance. Second, I analyze the frequency of lawsuits (*lis pendens* notices) in the archival sales data from Nebraska. 28% of land in the sample experiences a lawsuit over the period, with the rate actually lower (insignificantly) in odd sections. Overall, odd sections' reduced valuations seem to result from a consistent pattern in and out of contested grants like the NPRR. Based on available data, odd-section owners in other areas did not face greater legal issues with their titles.

C.4 Homestead Implementation in Railroad Grant Areas

Some historical sources argue that the Homestead Act was implemented differently in railroad grant areas. For example, proponents of the grant policy argued that doubling federal land prices in the grant area could compensate the government's loss of half its land. Other proposals would have set the standard settler plot size at 80 acres rather than 160. If implemented, these policies would complicate the RD analysis in Section 8 as multiple variables changed at the border. The even/odd regression's interpretation would be substantively unaffected since even squares would still be reserved for individual families. However, the exact policy details would require correction.

[11] While I use modern data due to it being available in a disaggregated form, Table 5 shows that these persistently reflect historical even/odd differences.

Based on historical and quantitative evidence, these proposals were not implemented to a significant degree in my sample. First, as noted by Gates (1954), the 80-acre rule was abandoned in 1879, preceding almost all settlement of my areas; the doubled \$2.50/acre price was not meaningful given that the vast majority of settlers opted for free land under the Homestead Act. Appendix Table A.5 is consistent with this narrative. There is no detectable difference in federal land grant sizes within the border and, belying a higher price, slightly more land was transferred. The statistically insignificant 12-acre point estimate would represent a 3% decrease in contrast to the 50% implied by the 80- versus 160-acre distinction. Thus, there is little qualitative or quantitative evidence that federal settlement policy changed at the borders in my sample.

C.5 Date of Settlement

If either Homestead or railroad lands were systematically settled earlier, any differences today could simply reflect some sort of first-mover advantage or head start from the earlier group. While comprehensive data on railroad sales are unavailable across all railroad grants, the archival sales data offer one window into this question. Appendix Figure A.6b shows the fraction of land that had at least one (non-railroad, non-federal) owner by year. Railroad and Homestead land were settled around the same time in this county, with neither group consistently experiencing a faster process.

C.6 Speculation

Gates (1936) and other historians viewed some large-scale railroad land buyers to be "speculators." One interpretation of this view is that those owners held their land off the market, aiming to let it appreciate in value following population increases rather than from their own investments. My results would thus primarily represent the long-term effects of a free-riding problem rather than land concentration per se. However, Gates connected speculation with land concentration, writing that tenant farming was one "of the worst effects of the resulting large-scale ownership [from these purchases]." Many speculators had long-term ambitions of "establishing for themselves a permanent investment from which they and their descendants might draw rents as the landed aristocracy of England had done for centuries" (Gates, 1941).

Quantitative evidence also cuts against the idea of odd-sections being held idly off the market. Appendix Figure A.6a indicates that they were transferred by their owners somewhat more frequently than even sections.[12] Very simply, odd-section owners were not typically holding their properties off the market, and by 1920, 99% of odd-sections had been transferred at least once and 59% had been transferred three or more times. Delayed investments from land held off the market should also not have been more harmful in areas with high rates of share tenancy, the pattern documented in Section 7.2. Both qualitative and quantitative evidence indicates that odd-section owners were in fact working their farms, making additional use of tenant farming relative to even-section owners. This element, rather than idle land, is key to the results.

[12] The data shown do not consider the "first" transfer from either the federal government or the railroad company in this graph.

C.7 Credit Constraints

In this section, I use archival data to provide evidence that even-section owners had more limited access to capital than odd-section owners. This finding supports the hypothesis that credit constraints played an important role in the slow reallocation process discussed in Section 7.3. However, other frictions could certainly have contributed and this paper does not aim to exhaustively list them; see Bleakley and Ferrie (2014) for other important work on this topic. As with the original Coase Theorem, many possible market imperfections would lead to the same key result that the initial allocation had long-term effects.

To measure landowners' access to capital, I use an archival sample of property tax records dating from 1900. Property taxes were a substantial cash obligation in this setting, meaning that difficulties paying them reflected a general lack of access to cash. For each parcel, the records list the land's owner, the date of the tax payment, and by whom the tax was paid. Essentially, all taxes are eventually paid in this context, but on average it took 24 months, and 71% of owners used an intermediary, indicating substantial difficulties for these settlers. On average, they paid their taxes off 5 months later (t=4.32). Even-section owners were also 6.7 percentage points (t=2.05) more likely to use an intermediary to pay.[13]

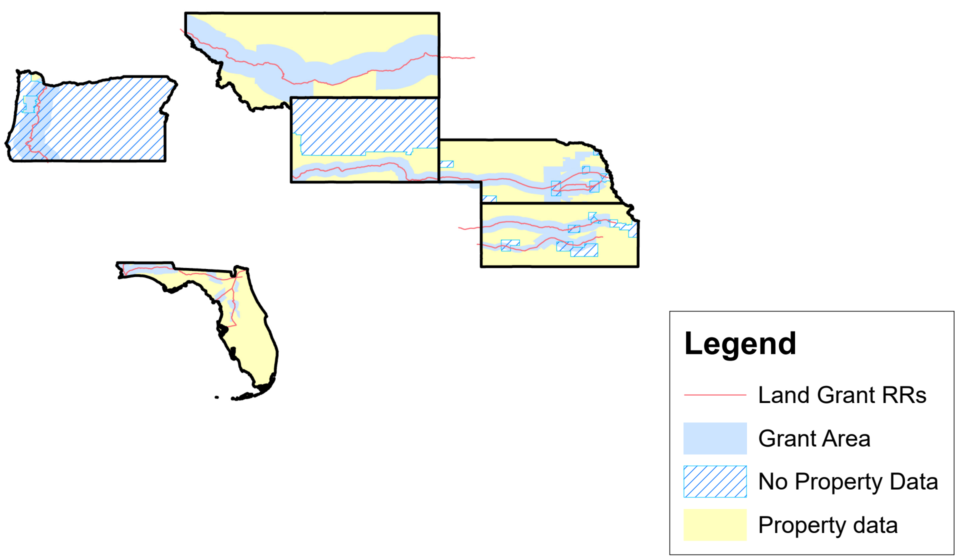
These delays and heightened reliance on intermediaries suggest that even-section owners had more limited access to capital than their odd-section counterparts. This result aligns well with the historical context: railroad land buyers were by definition capable of purchasing property, whereas the Homestead Act aimed to distribute land to individuals less able to do so.

[13]Both regressions include the full set of controls as in Table 3, column (6). Since the archival dataset includes just one county, standard errors are clustered at the township level as in similar cases.

D Appendix Tables and Figures

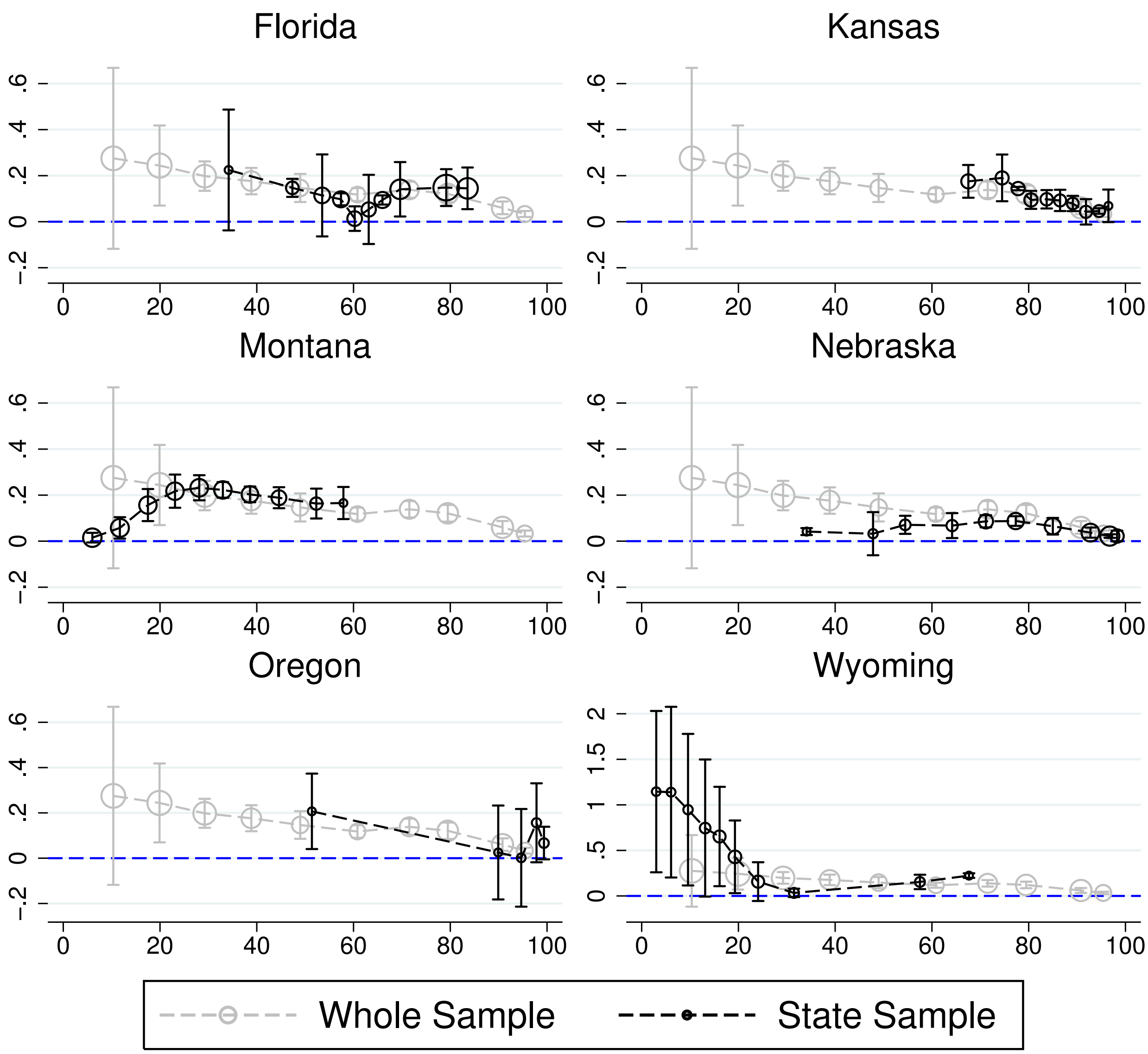
Figure A.1: The Public Lands Survey System

(a) Nebraska Townships and Numbered Sections



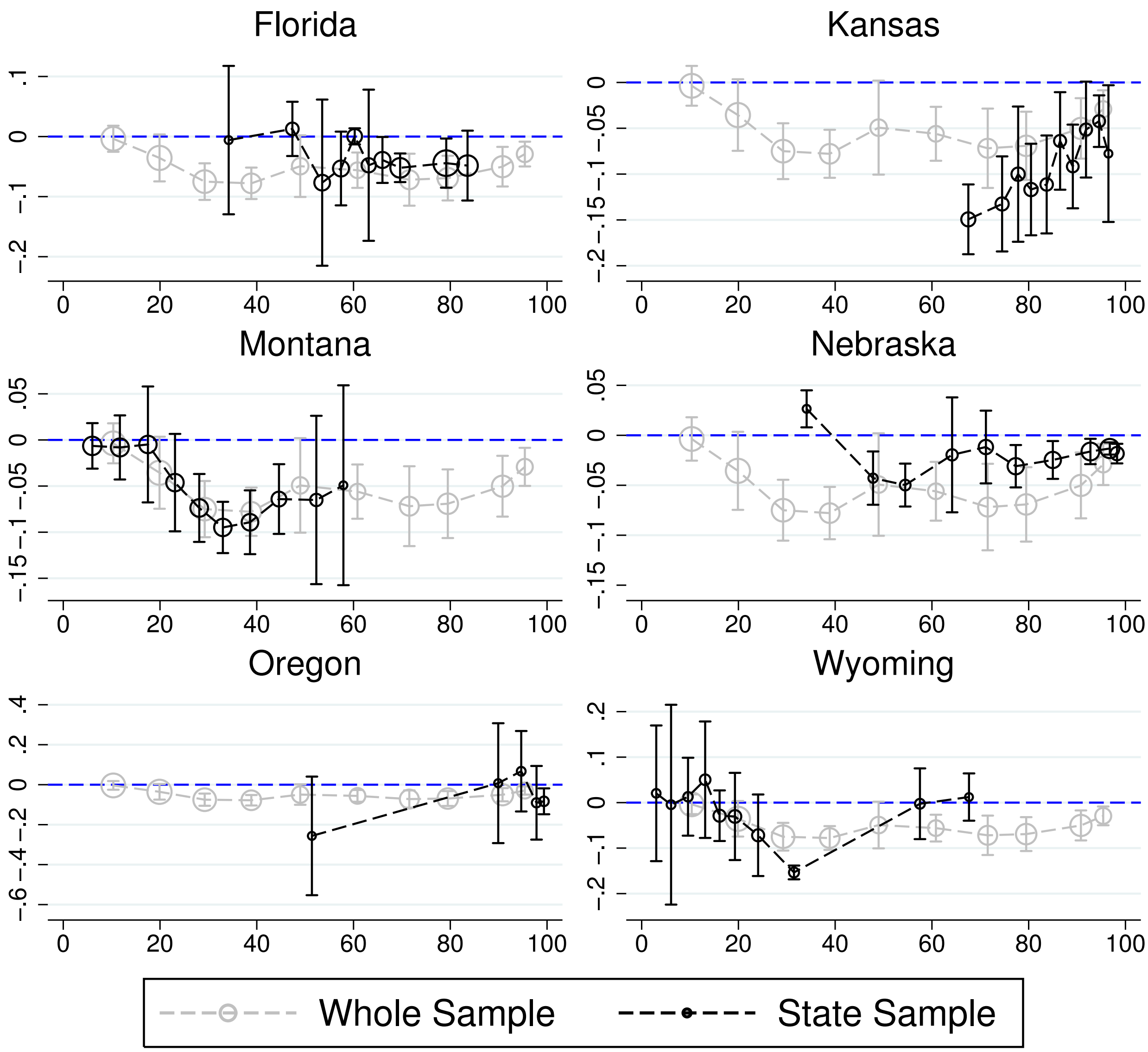
(b) Extent of Railroad Land Grants

Figure A.2: Effects on (log) Average Parcel Size



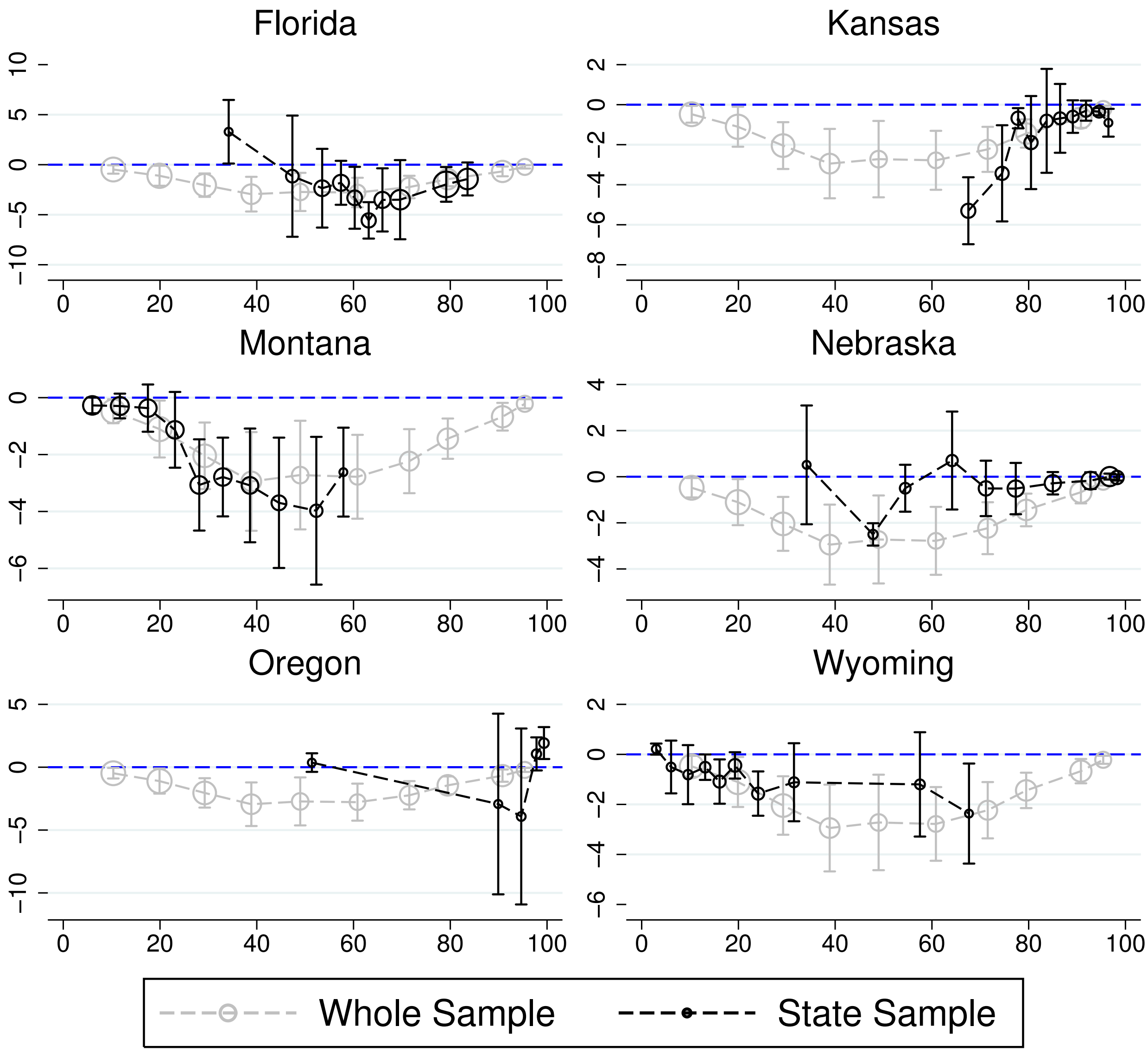
Notes: This graph shows full-sample and state-sample estimates of railroad land ownership on log(Acres / parcels) in a PLSS section as per the even/odd comparison of equation (1). Parcels that cover multiple sections are counted fractionally across each section so their total contribution sums to 1. Each dot represents a subsample of sections based on land quality according to the gSSURGO database. X-axis values reflect the average, full-sample percentile of land quality within the sample. State samples are chosen to reflect a 20-percentile range of the land quality within their state.

Figure A.3: Effects on (asinh) Land Value



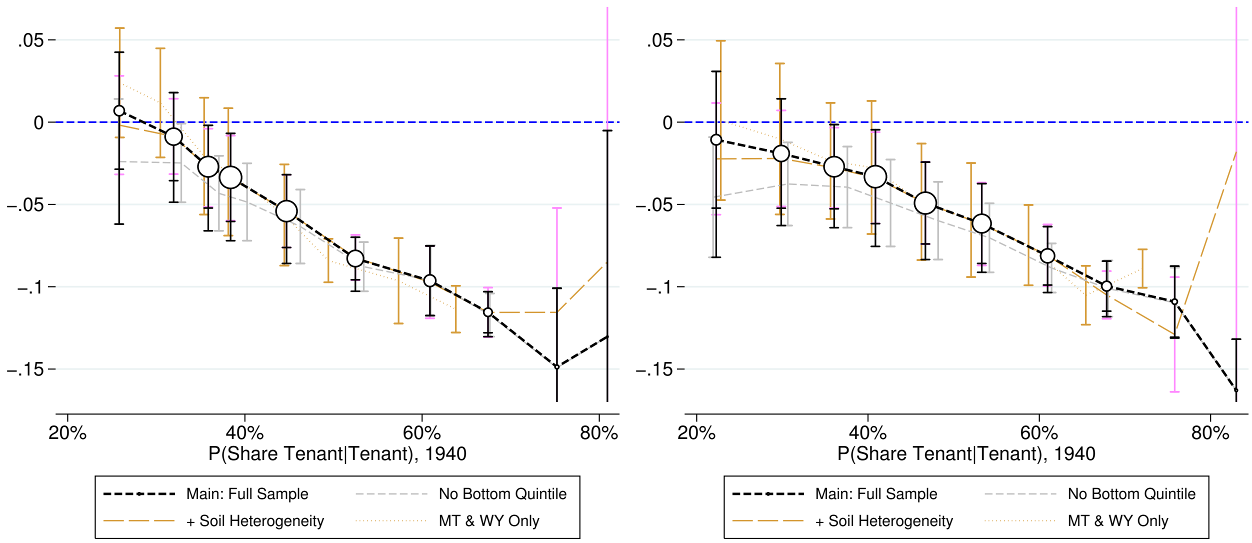
Notes: This graph shows full-sample and state-sample estimates of railroad land ownership on the (asinh) modern land value in a PLSS section as per the even/odd comparison of equation 1. Each dot represents a subsample of sections based on land quality according to the gSSURGO database. X-axis values reflect the average, full-sample percentile of land quality within the sample. State samples are chosen to reflect a 20 percentile range of the land quality within their state. Bars depict 95% confidence intervals.

Figure A.4: Effects on Crop Farms

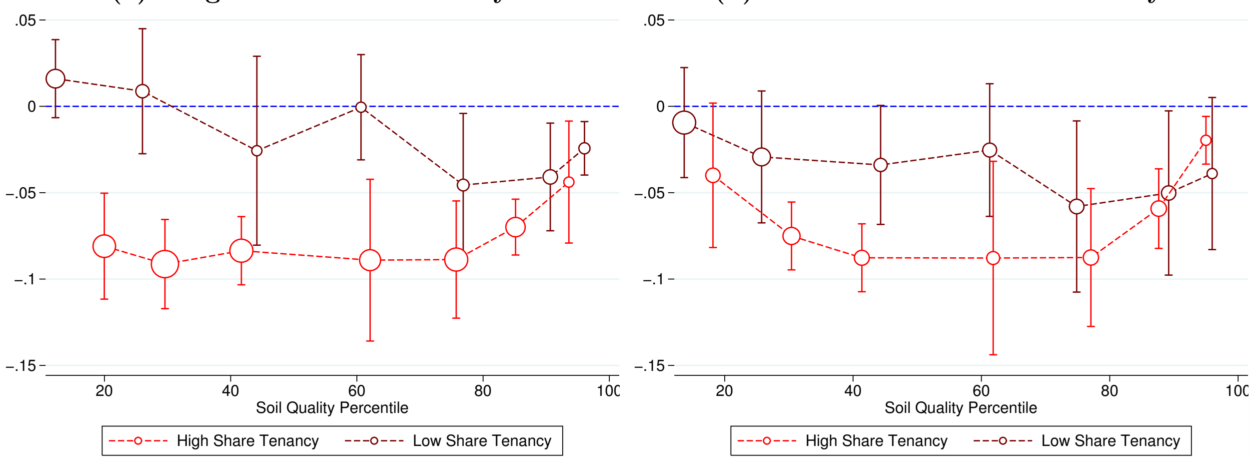


Notes: This graph shows full-sample and state-sample estimates of railroad land ownership on the percent of PLSS sections growing crops on 1% or more of their area, using the even/odd comparison of equation (1). Each dot represents a subsample of sections based on land quality according to the gSSURGO database. X-axis values reflect the average, full-sample percentile of land quality within the sample. State samples are chosen to reflect a 20 percentile range of the land quality within their state. Projected values are censored to remain within the 0-100% range. Bars depict 95% confidence intervals.

Figure A.5: Effects on Property Values by (Predicted) Share Tenancy



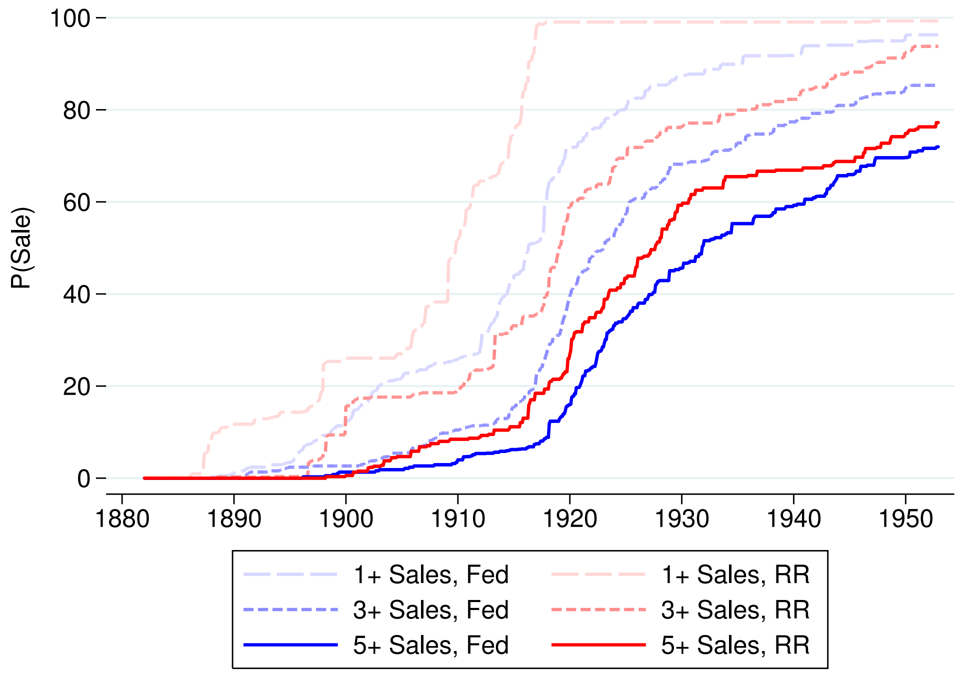
(a) Neighbors' Share Tenancy **(b) Geo-Predicted Share Tenancy**



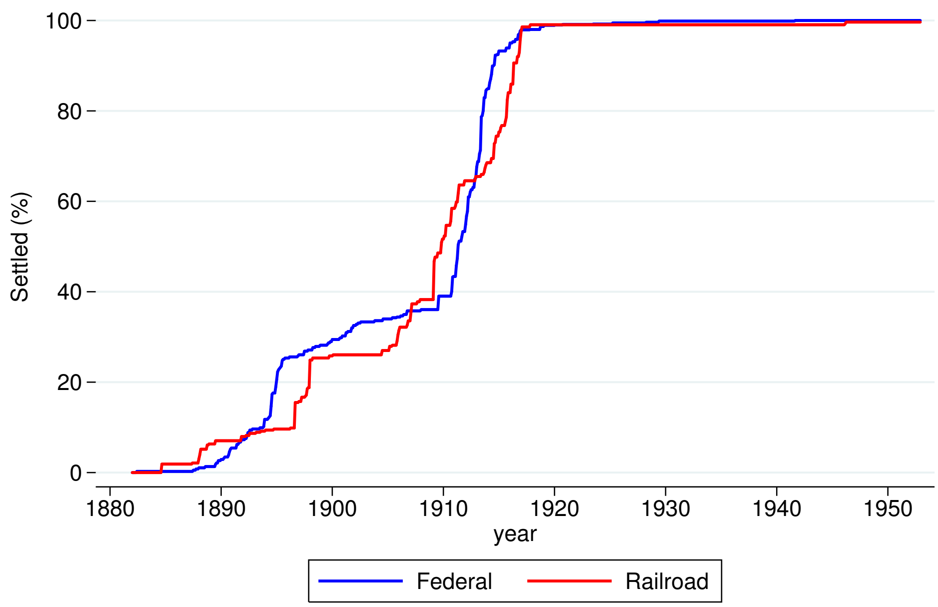
(c) Neighbors' Share Tenancy **(d) Geo-Predicted Share Tenancy**

Notes: This figure replicates the share tenancy heterogeneity results in Figure 4, using predicted rates of share tenancy instead of the county's own value. As such, the source of heterogeneity for any particular section is not determined by the section's own rates of share tenancy. (a), (c) use the average rate of share tenancy in neighboring counties within the same state as the prediction. (b)-(d) regress counties' share tenancy rates on the county-average values of the geographic characteristics and log(county area), using the regression-predicted values. (a)-(b) replicate Figure 4 based on the predicted levels of share tenancy. They add additional specifications that respectively drop the bottom quintile of observations based on gSSURGO soil quality; add a linear interaction between odd and soil quality; and a sample restricted to the states of Montana and Wymoing which have lowest soil quality among sample states. Panels (c)-(d) compare effects by soil quality percentile for areas above and below median rates of predicted share tenancy.

Figure A.6: Extent of Sales Over Time (archival sample)



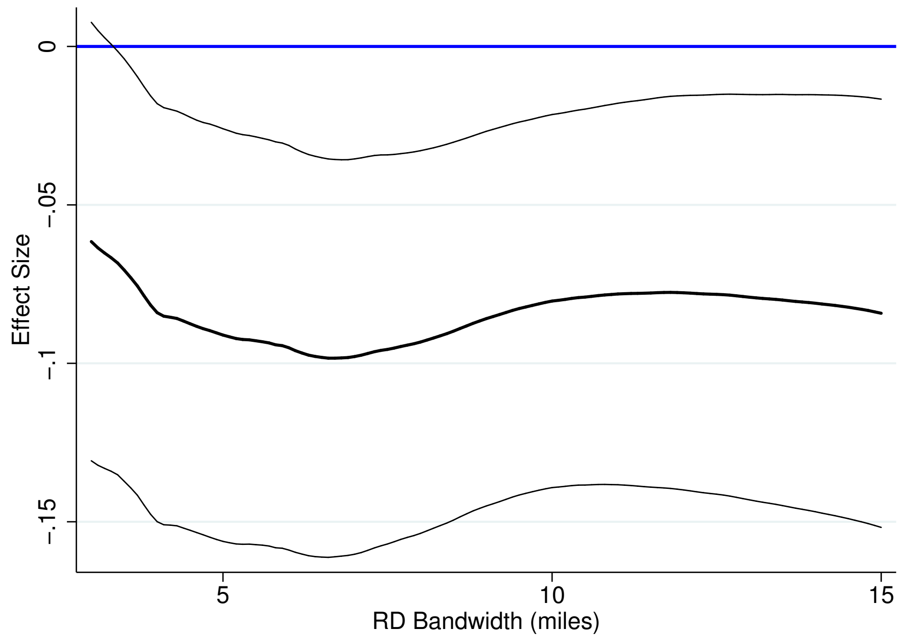
(a) Probability 1+, 3+, 5+ Cumulative Sales



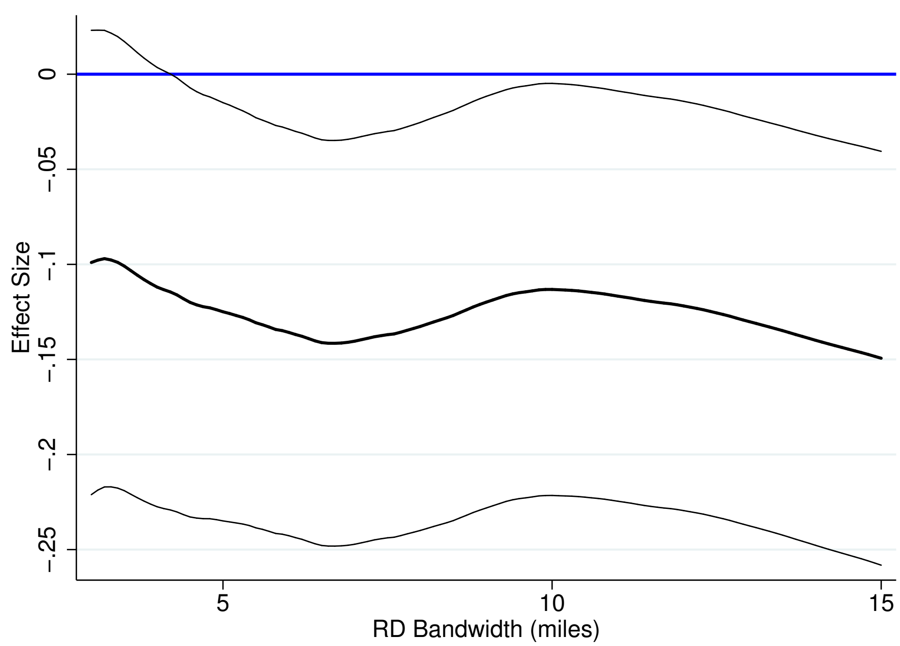
(b) Ever Settled

Notes: (a) depicts the percent of railroad versus federal parcels in Banner, NE that had been transferred 1+, 3+, or 5+ times by individual owners (i.e. excluding initial transfers from either the US government or railroad). (b) depicts the fraction of land that had been transferred to its first owners (ignoring the US government and railroad companies).

Figure A.7: RD Bandwidth Robustness



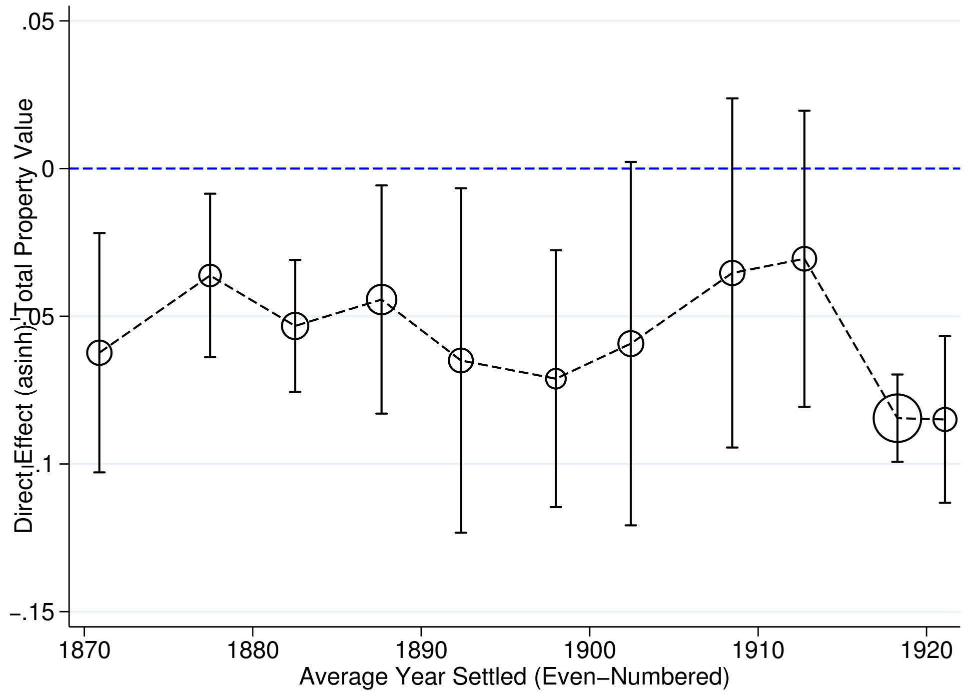
(a) Total Property Value Effect by Bandwidth



(b) Improvement Value Effect by Bandwidth

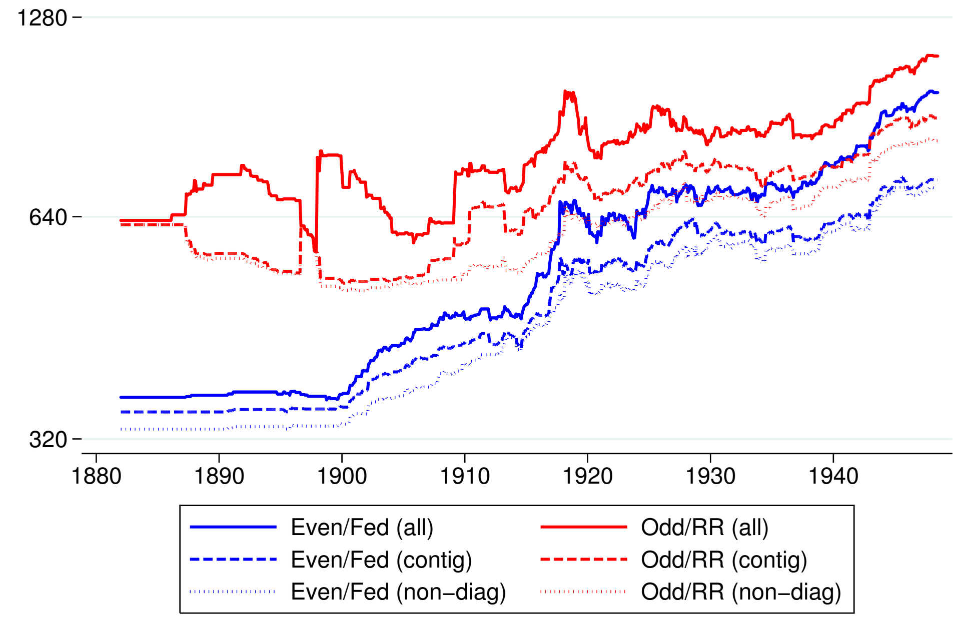
Notes: Estimates of equation (2) as a function of bandwidth, with 95% confidence intervals plotted. (a) plots (asinh) 2017 assessed total value, (b) plots (asinh) assessed improvement value.

Figure A.8: Effects by Year of Average County Settlement

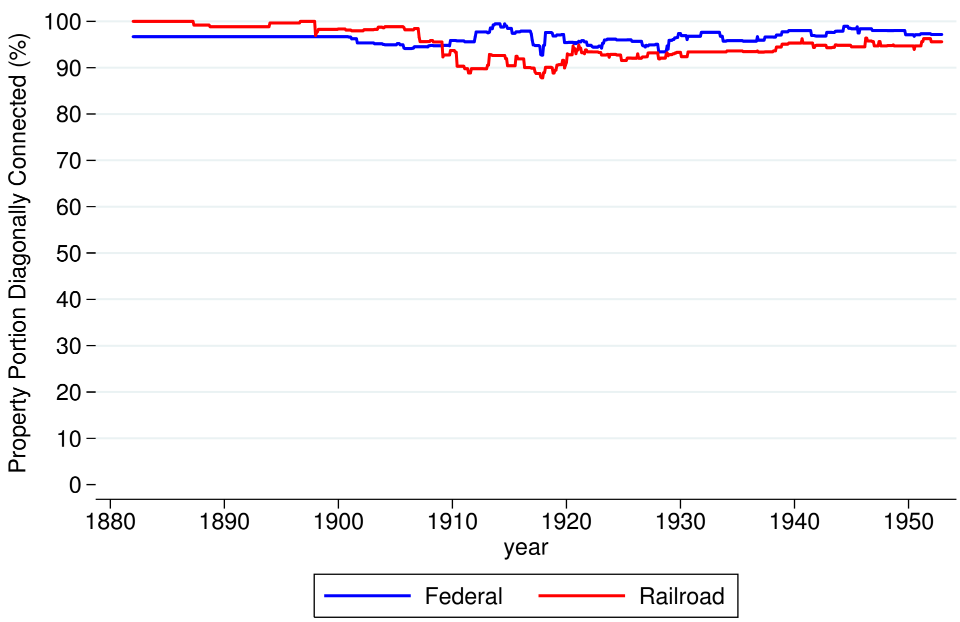


Notes: This graph shows full-sample and state-sample estimates of railroad land ownership on the (asinh) modern land value in a PLSS section as per the even/odd comparison of equation 1. Each dot represents a subsample of sections based on the average land was settled in the non-railroad lands of a county. This value is computed for each PLSS section as the average year of federal settlement for non-education, non-railroad sections within the county, excluding the section itself (i.e., "leave one out"). Bars depict 95% confidence intervals.

Figure A.9: Alternative Property Size Measures



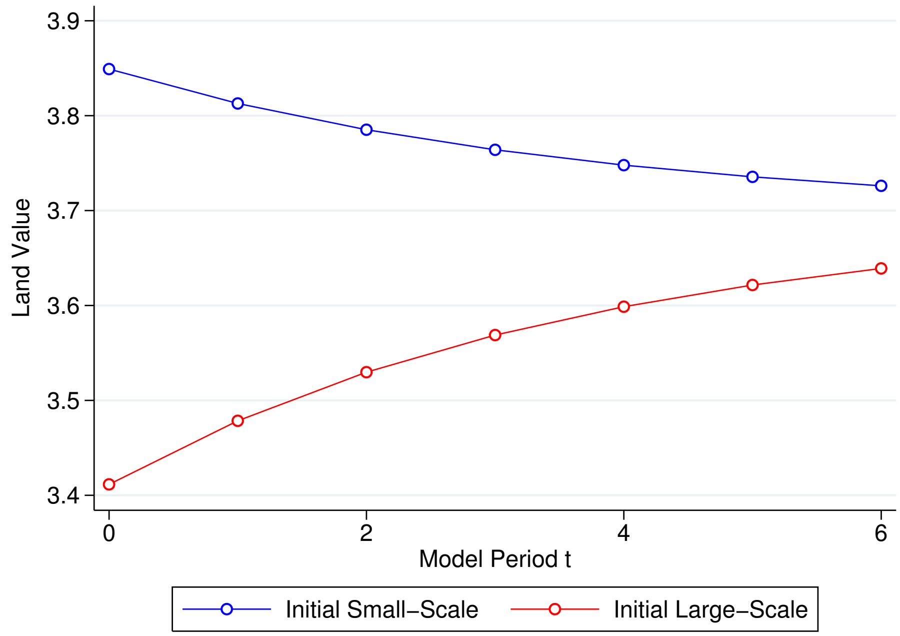
(a) Measures of Property Sizes



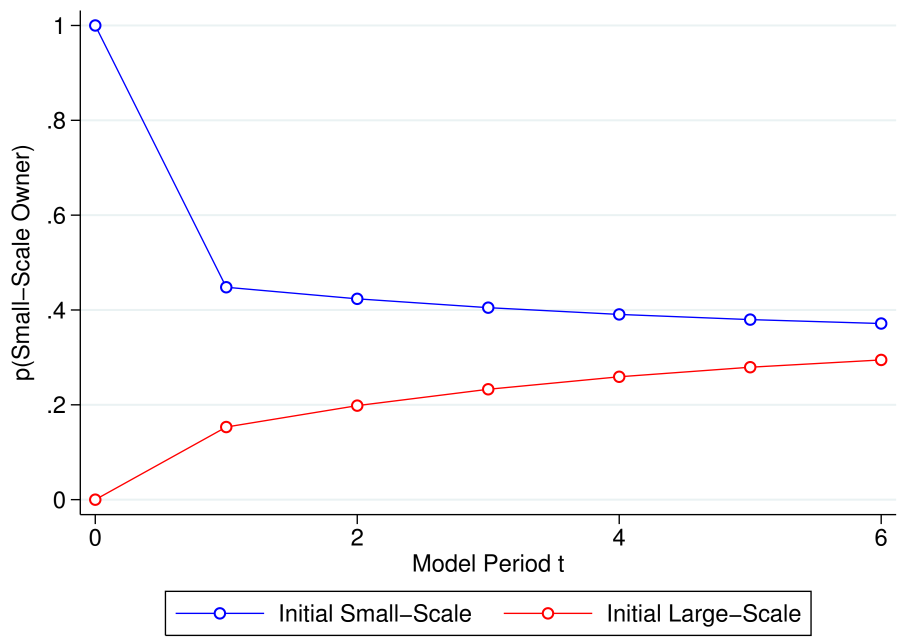
(b) Diagonal/Contiguous Property Size Ratio

Notes: property size measures over time based on archival sales data. (a) plots section-average log property sizes for even/odd sections based on an owner's entire holdings, contiguous holding, and contiguous holdings excluding diagonal connections. (b) plots the section-average ratio between the third and second of these groups.

Figure A.10: Sample Model Dynamics



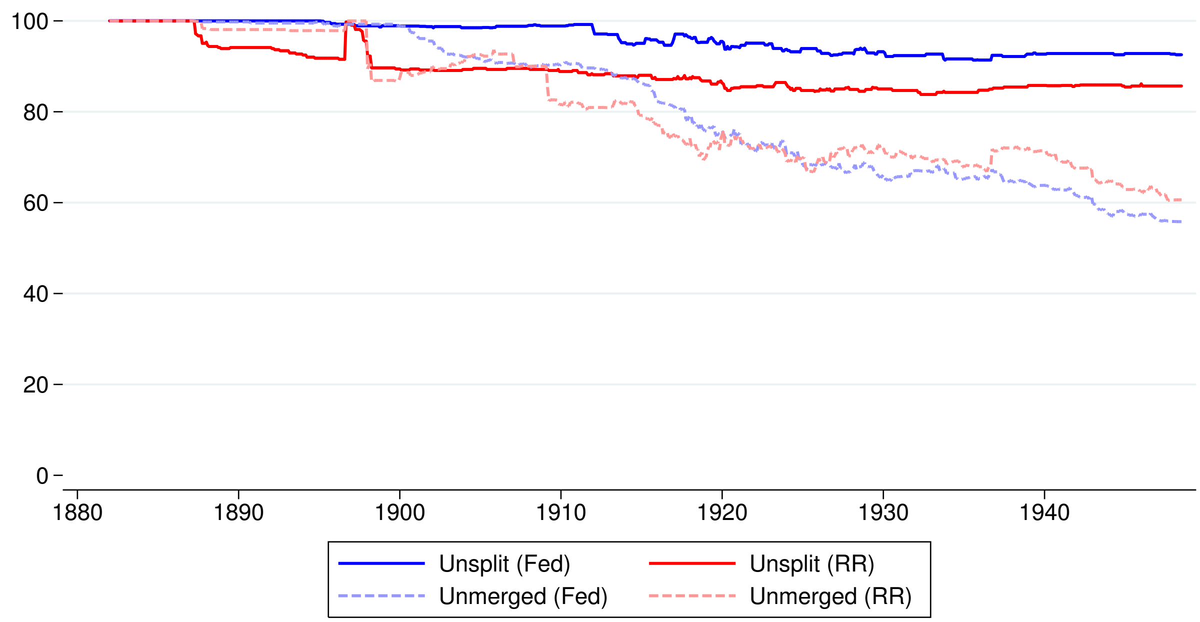
(a) Land Value



(b) Probability of Small-Scale Ownership

Notes: The figure shows expected land value and the probability of smallholder ownership for initial small- versus largeholder land. Parameter values are given by $A = 2$, $\beta = 0.7$, $\delta = 0.15$, and improvement costs of $r = 1$. Effort costs are quadratic: $\frac{1}{2}e^2$. Tenants face a limited liability and an outside option of 0, leading to an even-split sharecropping contract. S-type buyers face uniform costs on [0,2].

Figure A.11: Splitting and Merging of Initial Properties



Notes: the extent to which initial properties in the Banner, NE ownership panel remain unsplit or unmerged. See Appendix Section C.1 for definitions. A value of 100% indicates no change, lower values indicate more splitting or aggregation.

Table A.1: Sales Price and Assessed Value per Acre

	Panel A: Sales vs. Assessed Value, Section Level			
	(1) log(Sale Price/Acre)	(2) log(Sale Price/Acre)	(3) log(Sale Price/Acre)	(4) log(Sale Price/Acre)
log(Total Val/Acre)	0.94	0.51	0.61	0.68
	(0.0080)	(0.044)	(0.038)	(0.038)
log(Land Only Val/Acre)		0.14	0.18	0.11
		(0.051)	(0.034)	(0.033)
Sample	All	All	Agricultural	Agricultural
Township FEs				Y
SEs / Clusters	Township	Township	Township	Township
N	22,970	6,250	6,250	6,250
$\mathbb{E}[y]$	7.9	7.9	8.5	8.5

	Panel B: Sales vs. Assessed Value, Parcel Level			
	(1) log(Sale Price/Acre)	(2) log(Sale Price/Acre)	(3) log(Sale Price/Acre)	(4) log(Sale Price/Acre)
log(Total Val/Acre)	0.80	0.63	0.60	0.70
	(0.020)	(0.043)	(0.046)	(0.037)
log(Land Only Val/Acre)		0.23	0.14	0.038
		(0.035)	(0.036)	(0.028)
Sample	All	All	Agricultural	Agricultural
Township FEs				Y
SEs / Clusters	Township	Township	Township	Township
N	913,886	850,494	11,104	11,104
$\mathbb{E}[y]$	9	8.9	8.6	8.6

	Panel C: Use vs. Assessed Value, Section Level			
	(1) asinh(Value)	(2) asinh(Value)	(3) asinh(Value)	(4) asinh(Value)
asinh(Use Value)	0.42	0.46	0.25	0.23
	(0.0057)	(0.0087)	(0.0040)	(0.0045)
asinh(Ag. Use Value)		-0.066		0.10
		(0.0080)		(0.0038)
Sample	All	All	All	All
Township FEs			Y	Y
SEs / Clusters	Township	Township	Township	Township
N	339,482	339,482	339,482	339,482
$\mathbb{E}[y]$	7,434	7,434	7,434	7,434

Notes: This table correlates sales, assessed, and use values per acre. Sales data come from Florida tax records from 2016-17. It considers properties sold in 2016-17 with a positive sales price and reported acreage. Both the total property valuation and the valuation excluding "improvements" (buildings) are considered. Panel C correlates author-generated values based on land use with assessed values for the sample of property tax counties (regardless of railroad grant status); see Appendix Section B.9. Panel B uses data at the property level. Panels A and C aggregate values to the PLSS section level, as in the paper's main regressions for equation (1).

Table A.2: Archival Sample Description

Area (year)	Source	Variables	Where Used
Lincoln County, NE (1800s)	First individual owners (Federal: BLM records Railroad: deeds of sale)	Owner name, county of origin, property description	Figure 2, Table 6
Morrill County, NE (1912)	Land assessment, local elections	Owner name, property description, improved land, improvement value, officeseeking	Figure 3, Table 4, Table 6, Table A.5, Table A.4, Table A.7
Nebraska (1940)	Census enumeration district maps	Number of farms, schools, and other public goods by PLSS section	Table 5, Table A.7
Lincoln County, NE (1965)	Personal property assessment	Farm equipment, (share) tenancy by PLSS section	Table 5, Table 6
Perkins County, NE (1900)	Land assessment	Owner name, property description	Table 6, Table A.5
Kansas (1940) 30 townships Barton, Dickinson, Harvey, Pottawatomie counties	State agricultural survey	Operator name, property description, owner name	Table 6
Banner County, NE (1882-1948)	Land transfer records	Owner name, recipient name, property description, deed type	Figure 5, Figure A.6a, Table A.8

Notes: Descriptions of archival samples used in this paper. Kansas 1940 survey samples include only townships with complete lists of owners and operators. In many cases, the list of owners was left blank. Banner County, NE land records cover the 17N townships.

Table A.3: Summary Statistics (Archival Samples)

	PLSS Sections						Counties (1940)	
	(1) Number Sections	(2) Soil Quality (z-score)	(3) Homestead (%) (Even Only)	(4) Crops (%)	(5) Value \$000	(6) # Parcels (Median)	(7) Tenant Farm (%)	(8) Share Farm (% Tenant)
RR Grant Areas	132,463	-.113	86.9	47.9	2,231	2	38.8	42.8
Lincoln, NE (1800s, 1965)	2,084	-.107	99.3	44.4	1,078	2	49.2	35.2
Morrill, NE (1912)	101	-.273	93.3	41.6	307	1	55.7	63.3
Nebraska (1940)	18,622	.92	95.9	82.8	2,296	5	51.5	39.8
Perkins, NE (1900)	537	.345	98.5	98.9	1,398	4	54.4	55.9
KS State Census (1940)	738	1.45	83.6	96.5	2,626	7	42.3	43.6
Banner, NE (1882+)	204	-.278	96.6	72.5	338	2	42.7	71.7

Notes: The table presents summary statistics for different geographic units, focused on the archival data samples of Table A.2. Column (1) shows results for section sample size, column (2) for the gSSURGO crop productivity index (full-sample z-score), column (3) for percentages of non-railroad land transferred under the Homestead Act, column (4) for the percentage of sections with at least 1% in crops per the USDA CropScape data, column (5) for total property values, column (6) for the median number of parcels, column (7) for county-level average rates of non-owner-operated (tenanted) 1940 farms, and column (8) for county-level averages of the shares tenant farms as a fraction of all tenant farms in 1940.

Table A.4: Land Values — Functional Form and Heterogeneity

	Panel A: Functional Form (Total Property Value)				
	(1) asinh(x) (baseline)	(2) ln(1+x)	(3) ln(max(1,x))	(4) $x > 0$ (%)	(5) $x >$ median (%)
RR Effect	-0.045	-0.045	-0.046	-0.015	-1.49
	(0.014)	(0.013)	(0.013)	(0.026)	(0.39)
Grant × State FEs	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y
Township FEs	Y	Y	Y	Y	Y
SEs / Clusters	Spatial	Spatial	Spatial	Spatial	Spatial
N	132,463	132,463	132,463	132,463	132,463
$\mathbb{E}[y]$	\$2,134k	\$2,134k	\$2,134k	1.0e+02%	50%

	Panel B: Functional Form (Investments)				
	1912 Sample			Full 2017 Sample	
	(1) Imp. Value > 0 (%)	(2) (asinh) Imp. Value / owners	(3) Acres Imp. (% Section)	(4) Imp. Value > 0 (%)	(5) (asinh) Imp. Value, non-home
RR Effect	-24.1	-1.14	-9.93	-3.68	-0.16
	(8.01)	(0.19)	(4.09)	(1.00)	(0.034)
Grant × State FEs	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y
Township FEs	Y	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y	Y
SEs / Clusters	Township	Township	Township	Spatial	Spatial
N	101	82	101	132,463	132,463
$\mathbb{E}[y]$	23%	\$2.7k	13%	43%	\$412k

	Panel C: Heterogeneity				
	(1) (asinh) Value Total	(2) (asinh) Value Ag.	(3) Crop Farm (%)	(4) (asinh) Value Improvements	(5) (asinh) Pop
RR Effect	-0.059	-0.045	-1.85	-0.30	-0.11
	(0.013)	(0.013)	(0.49)	(0.038)	(0.011)
RR × Low	0.052	0.064	1.38	0.25	0.078
	(0.012)	(0.016)	(0.46)	(0.038)	(0.012)
Grant × State FEs	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y
Township FEs	Y	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y	Y
SEs / Clusters	Spatial	Spatial	Spatial	Spatial	Spatial
N	132,463	132,462	132,462	132,463	132,463
$\mathbb{E}[y]$	\$2,231k	\$380k	48%	\$1,277k	23

Notes: This table extends Table 4 with alternative functional forms for the outcomes and heterogeneity. Panel A focuses on functional form. (1) and (4) considers the extensive margin of improvements. (2) studies the (asinh) value of improvements divided by the number of individual owners who own land in the section. (3) studies the fraction of a section's land marked as improved. (5) focuses on the value of improvements excluding homes and dwellings. Panel B considers an interaction effect with low land quality, defined as a gSSURGO quality measure in the bottom 20% of the sample. All data are from the full modern sample and respectively use modern total property value, imputed use value based on satellite data, the extensive margin of crop farming, the value of improvements, and population.

Table A.5: Checkerboard Area Effects

	Panel A: Main Estimates					
	Baseline			Drop 1-Mile Donut		
	(1) (asinh) Total Value	(2) (asinh) Value Improvements	(3) (%) Any Improved	(4) (asinh) Total Value	(5) (asinh) Value Improvements	(6) (%) Any Improved
In Checkerboard [Even]	-0.098	-0.14	-1.28	-0.18	-0.18	-1.46
	(0.038)	(0.065)	(0.97)	(0.066)	(0.095)	(1.73)
Grant × State FEs	Y	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y	Y	Y
SEs / Clusters	County	County	County	County	County	County
N	32,511	32,511	32,510	27,214	27,214	27,213
N (clusters)	162	162	161	162	162	161
$\mathbb{E}[y]$	$1,674k	$998k	51%	$1,674k	$998k	51%

	Panel B: Land Quality Balance					
	(1) Soil (z-score)	(2) Slopes (z-score)	(3) Streams (z-score)	(4) Elevation (z-score)	(5) log(Area)	(6) log(RR Dist)
In Checkerboard [Even]	-0.012	0.0062	0.024	0.0018	0.0032	-0.0058
	(0.014)	(0.0063)	(0.025)	(0.0059)	(0.0034)	(0.0033)
Grant × State FEs	Y	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y	Y
Geo Controls	N	N	N	N	N	N
SEs / Clusters	County	County	County	County	County	County
N	39,825	39,825	39,825	39,825	39,825	39,825
N (clusters)	162	162	162	162	162	162
$\mathbb{E}[y]$	.059	.88	.47	1.6	-.017	3.2

	Panel C: Federal Settler Characteristics					
	(1) Acres Granted	(2) Ever Granted (%)	(3) Public Land 2017 (%)	(4) Occ. Income	(5) Farm Home (%)	(6) Owns Home (%)
In Checkerboard [Even]	-12.5	1.28	-0.84	-0.13	2.21	-1.68
	(9.73)	(0.76)	(0.71)	(0.40)	(1.76)	(3.31)
Grant × State FEs	Y	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y	Y
Geo Controls	Y	N	Y	Y	Y	Y
SEs / Clusters	County	County	County	County	County	County
N	24,122	32,511	31,754	7,108	8,156	2,967
N (clusters)	157	162	161	135	137	104
$\mathbb{E}[y]$	396 ac	58%	27%	14%	56%	71%

Notes: RD comparisons of federal sections per equation (2). Panel A considers (1)-(2) 2017 total and improvement value (3) owned acreage in 1900s assessments (4) lack of census microdata link to 1900s owner (5)-(6) number of distinct CropScape land uses and extensive margin of crop farming. Panel B considers the geographic characteristics analyzed in Table 2. Panel C considers (1) average acres per grant, top-coded at the 95$^{\text{th}}$ percentile (2) the percentage of land ever granted (3) the percentage of public land in 2017 (4)-(6) consider the characteristics of settlers linked to census microdata in the decade before their grant.

Table A.6: Distribution of Population Effects

	Panel A: Town Outcomes, Even/Odd					
	(1)	(2)	(3)	(4)	(5)	(6)
	# Towns CDPs	# Towns Schmidt (2018)	Pop $\geq$ 1 (%)	Pop $\geq$ 10 (%)	Pop $\geq$ 100 (%)	Pop $\geq$ 1000 (%)
RR Effect	0.00029	0.0010	-3.63	-1.02	-0.046	0.0085
	(0.00024)	(0.00059)	(0.66)	(0.30)	(0.054)	(0.019)
Sample	All	All	All	All	All	All
Grant × State FEs	Y	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y	Y
Township FEs	Y	Y	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y	Y	Y
N	132,463	132,463	132,463	132,463	132,463	132,463
$\mathbb{E}[y]$	.024	.0039	33%	11%	3%	.58%

	Panel B: (asinh) Population Within X Miles					
	(1)	(2)	(3)	(4)	(5)	(6)
	1 mile	2 miles	3 miles	4 miles	5 miles	10 miles
RR Effect	0.0012	-0.0040	0.0044	0.0032	-0.0013	0.0012
	(0.0033)	(0.0034)	(0.0012)	(0.0025)	(0.0018)	(0.0033)
Grant × State FEs	Y	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y	Y
Township FEs	Y	Y	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y	Y	Y
N	132,463	132,463	132,463	132,463	132,463	132,463
$\mathbb{E}[y]$	74	292	648	1,140	1,774	74

Notes: This table tests for effects of railroad land grants on town formation. Panels A-B use PLSS-section level data on the fraction of land in a census place, the Schmidt (2018) number of towns, and the satellite-based population. Panel A explores the even/odd comparison from equation (1). Panel B studies the (asinh) population in 2019 within specified distances of a random point within each section.

Table A.7: Public Goods and Political Behavior

	Panel A: Even/Odd				
	(1) Schools	(2) Churches	(3) Community Halls	(4) Road Distance	(5) Owner Seeks Office (%)
RR Effect	-0.014	-0.00022	-0.0010	0.0021	-3.61
	(0.0100)	(0.00078)	(0.00035)	(0.00076)	(5.05)
Sample	NE & KS 1940	NE & KS 1940	NE & KS 1940	All 2015	Morrill 1912
Grant × State FEs	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y
Township FEs	Y	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y	Y
N	18,622	18,622	18,622	132,463	82
$\mathbb{E}[y]$	.096	.013	.0025	1.1 mi	5.5%

	Panel B: In Checkerboard (Federal Only)				
	(1) Schools	(2) Churches	(3) Community Halls	(4) Road Distance	(5) Owner Seeks Office (%)
In Checkerboard [Even]	-0.011	0.00067	-0.00060	0.051	-5.21
	(0.012)	(0.0047)	(0.0011)	(0.042)	(3.45)
Sample	NE & KS 1940	NE & KS 1940	NE & KS 1940	NE & KS 1940	Morrill 1912
Grant × State FEs	Y	Y	Y	Y	Y
County FEs	Y	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y	Y
N	18,514	18,514	18,514	296,289	525
$\mathbb{E}[y]$	.086	.01	.00054	1.3 mi	4.9%

Notes: This table studies the presence of public goods, tax records, and officeseeking on PLSS sections. Panel A compares even and odd sections using equation (1). Panel B considers even (Homestead) sections within the grant area differ from those outside using equation (2). Columns (1)-(3) count the number of schools, churches, and community halls according to 1940 census enumeration district maps. (4) measures the distance from the section's centroid to the closest road in 2015. (5) uses an archival case study from Perkins, NE in 1900 which counts the number of months owners took to pay their property tax bill. (6) uses an archival case study from Morrill, NE in 1912 and computes the fraction of owners in a section who ran for county and sub-county elected office.

Table A.8: Property Rights and Legal Disputes

	(1) asinh(Value) Baseline	(2) asinh(Value) No NPRR	(3) asinh(Value) No NPRR, OCRR	(4) Recorded Lawsuit (%)
RR Effect	-0.045	-0.049	-0.047	-2.63
	(0.014)	(0.014)	(0.014)	(5.54)
Grant $\times$ State FEs	Y	Y	Y	Y
County FEs	Y	Y	Y	Y
Township FEs	Y	Y	Y	Y
Geo Controls	Y	Y	Y	Y
SEs / Clusters	Spatial	Spatial	Spatial	Township
N	132,463	70,210	68,788	204
$\mathbb{E}[y]$	\$2,231k	\$3,003k	\$2,732k	28%

Notes: The table shows even/odd comparisons per equation (1). (1)-(3) replicate Table 3, Panel A. (2) drops the Northern Pacific Railroad grant and (3) additionally drops the Oregon and California Railroad grant. (4) analyzes the Banner County sales data with the outcome being the fraction of land in a section that ever experienced a lawsuit (*lis pendens* notice) during the period.

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