Use It or Lose It:
Adverse Possession and Economic Development

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Abstract

The legal doctrine of adverse possession limits the security of property rights by transferring formal land titles from absentee owners who leave their land idle to adverse possessors that use the land. This paper exploits historical changes in adverse possession legislation in U.S. states between 1840-1920 to investigate the causal effects of the security of land titles. I find that a reduction in the security of titles increased agricultural output. The main channel is incentivizing higher land utilization. A reduction in the security of land right is also associated with an increase of investment in farms and improved access to capital markets, as well as with an increase in the share of owner-cultivated farms and mid-size farms. These findings suggest that the effect of property rights on economic development is not monotonic, and that property rights may be over secure.

Keywords: Property Rights, Land Titles, Adverse Possession, Squatter's Rights, Development, U.S. Economy, Agriculture

1 Introduction

In *The Second Treatise of Government*, John Locke famously sets limits on property rights, claiming that the property one can claim is bound to the amount she can use in a beneficial way, such that it will not be wasted (Locke, 2002).[1] John Stuart Mill makes similar claims in his known 1848 *Principles of Political Economy*, claiming that exclusive property rights in land ought to be conditioned on the actual use of the land for the production of goods, and that unused land cannot be regarded as private property (Mill, 1970).[2] These moral arguments are implemented in the legal doctrine known as "adverse possession," under which landowners who leave their land idle face the risk of having their title transferred to an adverse possessor who occupies the land for a statutorily-determined prescriptive period. The legislation limits the security of land ownership and reallocates titles outside of formal markets away from idle owners and toward the adverse possessors.

This paper exploits plausibly exogenous variation in the security of land titles, as a result of historical state-level changes of adverse possession prescriptive periods between 1840-1920, in order to investigate the causal effects of the security of land titles. During this period the U.S. was expanding westward and a huge amount of undeveloped land was settled on and allocated as private property. In many areas land ownership was initially concentrated and significant shares were owned by absentee owners who purchased land as a speculative investment. At the same time, squatting on undeveloped land was a common practice among settlers, both on public land and on private land. Moreover, formal titles would sometime conflict and overlap with other titles. Those historical circumstances made adverse possession legislation particularly important. After 1920 the westward expansion and the cash sale of public land both essentially ended (figure 1), and by that time the amount of adverse possession cases had sharply declined (figure 2).

I coded states' historical adverse possession prescriptive periods from a variety of primary

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[1]This is one of two famous Lockean provisos: the "enough and as good" proviso and the "spoilage" proviso.

[2]See for example: "[...] in the case of land, no exclusive right should be permitted in any individual, which cannot be shown to be productive of positive good. [...] When land is not intended to be cultivated, no good reason can in general be given for its being private property at all" (Mill, 1970, pp. 231-232).

legal sources and constructed a novel dataset spanning a century. Between 1840-1920, eighteen states and territories changed the prescriptive period, some more than once, resulting in twenty-three "natural experiments", out of which 16 are reductions of the period and 7 are increases. Intuitively, a shorter prescriptive period implies less secure land titles. The use of the adverse possession prescriptive period as a measure of land right protection has the advantage of being very clear, simple and transparent, as opposed to the complex property rights indices that are sometimes used in this literature. I then matched this dataset with county level data on agricultural outcomes from the U.S. Census of Agriculture (Haines and ICPSR, 2010) and estimate the impact of states' prescriptive periods on agricultural outcomes.

The main finding of this paper is a negative causal effect of the security of land titles, measured by the prescriptive period in adverse possession legislation, on agricultural output. Legislation changes that made it easier for illegal occupiers to acquire formal title to land they regularly use are associated with a higher value of agricultural production. In my baseline specification, the average causal effect of a one-year decline in the prescriptive period is a 5.3 ($SE = 1.5$) cents increase in the real value of annual agriculture production per county acre. In order to interpret the magnitude of this effect, note that the average prescriptive period had declined from 19.42 years in 1840 to 14.94 years in 1920 (table A.1), which amounts to an average of $5.3 \times (19.84 - 14.94) \approx 26$ cents, or about 8 percent compared to the sample mean of 3.3 dollars. This result is robust to variations in sample and specifications. A non-parametric analysis of the effect in a dynamic difference-in-differences specification reveals a flat pre-trend and a sharp and significant non-linear increase of output after a decrease in the security of land titles. Following a one-year decrease in the prescriptive period, the value of agricultural output per county acre increases by the first decade by a about 3.3 cents, with a farther subsequent increase in the next decade, followed by a reversion to trend five decades after.

Studying the dynamic response to changes in the prescriptive period in a non-parametric way also helps establishing a plausible causal interpretation. First, it gives rise to a causal interpretation in the spirit of Granger (1969), by documenting an absence of pre-trends prior to the change in the security of titles, and showing that the divergence from the long-run trend only occurs af-

3

ter the legislation, and not before. Second, I estimate a flexible dynamic difference-in-differences specification, which allows for increases and decreases of the prescriptive period to have different dynamic effects. I show that, as expected under a causal interpretation, they have opposite and quite symmetric dynamic effects on agricultural output.

I perform two other exercises in the spirit of Granger (1969) to assess the plausibility of my identification assumptions. In my baseline fixed affects design, I show that the lead and lag of adverse possession legislation is not correlated with agricultural output, which suggests that the legislation changes were unexpected and that there are no political economy feedback from output into future legislation. I also show that at the state level, changes in agricultural output do not Granger-Cause changes in adverse possession legislation. I also use narrative evidence in order to limit the sample to include only legislation changes that are a part of a comprehensive revision of states' codes. Those changes are even more likely to be orthogonal to the pre-trends in agricultural output. My baseline result holds in this restricted sample as well.

Finally, I perform two placebo experiments to validated my baseline result. The first randomly allocates treatment across states. It suggests that it is highly unlikely that the result is obtained by mere chance. The second placebo experiment randomly assign treatment dates within treated states. It suggests that it is highly unlikely that the result is driven by other factors that only happen to roughly line up with the changes in adverse possession legislation.

I then turn to study channels. The main channel behind the results appears to have been higher land use on the extensive margin: I find that while total agricultural output increased following shortening of the prescriptive period, output per acre did not. Indeed, I find that a one-year decline of the prescriptive period is associated with about 0.75 percent increase in farm acres compared to the sample mean. Adverse possession also had an effect on land allocation. More secure land titles decreased the share of cultivator-owned farms and the share of mid-sized farms. While these effects might have merit on their own, their magnitude is too small to be a primary driver of the main result. I also rule out investment as a leading channel, as the results regarding the average linear effect are mixed, and most evidence point to a non-monotonic relationship between the prescriptive period and farm investment. Finally, a decline

4

of the prescriptive period is also associated with an increase in the share of farms with mortgage. This suggests that less secure property rights for absentee owners could have improve the access of others, presumably, the farmer-squatters on their land, to capital markets.

This paper makes three main contributions to the literature. First, it contributes to a literature in law and economics on adverse possession legislation (Baker et al., 2001; Merrill, 1985; Miceli and Sirmans, 1995; Netter, 1998; Netter et al., 1986). This study documents and quantifies for the first time the positive economic impact of adverse possession legislation. My results support a common theoretical justification for adverse possession in the literature, arguing that by transferring land title to individuals who use the land, adverse possession ensures that valuable land will not lay idle, vacant and unimproved for long periods of time.[3] Indeed, I show that the legislation had a positive impact on land utilization. As more land is used in a productive manner, agricultural production increases. This finding is particularly important because this argument was downplayed by earlier papers in economics on adverse possession, who regarded it as "problematic," "not valid," or even "dubious" (Merrill, 1985; Miceli and Sirmans, 1995; Netter, 1998; Netter et al., 1986).[4]

Second, it sheds light on an interesting institution that contributed to a more egalitarian and democratic pattern of land ownership at a crucial period in the U.S. history, when the nation's political and economic institutions were still shaping. This speaks to an important literature that is focused on the distribution of land, its interaction with the quality of institutions, and its effect on development (Garcia-Jimeno and Robinson, 2011; Engerman and Sokoloff, 2002).

Last but not least, this paper speaks to a large literature on property rights and economic

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[3]The literature generally highlights three other main justifications for adverse possession (Merrill, 1985). The first is the general argument in favor of limitation in legal actions - since record keeping is costly, evidence is in general less reliable after long periods. Thus, after a long period of time the main weight should be given to possession, as "possession is nine tenth of the law." Second, in an environment of imperfect land title records, adverse possession reduces the risk of claims from past legitimate owners, thus removing barrier to trade and investments in land (Baker et al., 2001; Netter et al., 1986). The third justification is that after a long period of time the adverse possessor develops an economic attachment to the land that is likely to be greater than that of the original owner, such that removing the adverse possessor will do more harm than good. Miceli and Sirmans (1995) argue that "this justification makes sense only in the case of inadvertent squatting, as when a boundary error occurs." (p. 161)

[4]The basic reasoning behind these statements seems to be that leaving the land idle could be the optimal action from the perspective of the true owner. Behavioral and informational biases, or market imperfections that create a wedge between the private returns and the social returns, are not considered.

development that suggests that well-defined and secure property rights are important for long run economic development (Acemoglu et al., 2001; Besley and Ghatak, 2009). In particular, insecure property rights reduce incentives to investment (Besley, 1995; Field, 2005; Goldstein and Udry, 2008; Hornbeck, 2010), cause misallocation of economic resources (Field, 2007; Hornbeck, 2010), hinder trade (Lanjouw and Levy, 2002) and prevent access to financial markets (De Soto, 2000).[5] However, the literature also suggests that flexible property rights that enable the political authority to reallocate and redistribute property, often involuntarily, might also have a positive effect on economic outcomes (Banerjee et al., 2002; Besley and Ghatak, 2009; Galiani and Schargrodsky, 2010; Lamoreaux, 2011).

In relation to this literature, I find that a shorter prescriptive period in adverse possession legislation causes a sizable increase in agricultural production. This finding is important, because it suggests that property rights may be too restrictive and *over secure*. During the American Westward Expansion, more secure land titles for absentee owners slowed economic development. While a shorter prescriptive period makes property right less secure and more flexible, it does so in a very specific way. It limits the security of the rights of landlords who leave their land idle, and facilitates redistribution of only *unemployed* land. At the same time, the rights of owners who make use of their assets remain perfectly protected.[6] My analysis suggests that this institutional design was conducive to agricultural productivity. More generally, this paper suggests that the relationship between property rights and economic development is complex, and that the effect of an increase in the security of property rights may depend on the economic and historical circumstances.

But what distinguishes the case studied in this paper from many other cases studied in the literature? Acemoglu and Robinson (2012) highlight property rights as an important component of inclusive institutions, which are conducive to economic growth. My hypothesis is that the

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[5]Evidence on this channel are ambiguous. Also see Field and Torero (2008), Galiani and Schargrodsky (2010) and Wang (2012).

[6]One might even claim, that a shorter prescriptive period increase the security of land titles of non-absentee owners. The risk of losing titles due to old legitimate claims is alleviated. This channel might contribute to the results regarding the increase in access to capital markets and investments, however it can not explain the increase in land use, and therefore, cannot be the main factor driving the increase in output.

extent to which secure property rights promote an inclusive society depends on the distribution of property. In other words, perfectly secure property rights are not inherently inclusive. When the initial allocation is highly unequal, perfectly secure property rights might preserve the initial allocation of economic and political power. The literature suggests that the initial allocation matters when trade costs prevents markets from achieving the efficient allocation under institutions of secure property rights (Coase, 1960). This seems particularly important in the historical context studied in this paper, and more generally in past centuries and in developing economies: upfront payment was usually required and capital markets were imperfect, search costs were substantial, title record keeping was imperfect, which resulted in a risk of fraud, and contracting was generally expensive. Bleakley and Ferrie (2015) found that in 19th century Georgia, trade cost resulted in highly persistent land ownership patterns, were the initial misallocation depressed the value of land. My results support the hypothesis that by reducing the security of land titles, adverse possession legislation helped to achieve a more efficient allocation of land.

During the period in which the United States was expending to the west and land distribution was initially concentrated and "at variance with American democratic ideals" (Gates, 1973, p. 139), a *reduction* in the security of land titles of absentee owners in fact created a *more inclusive* economy. Although at odds with secure property rights, redistributive institutions, such as adverse possession legislation, which transferred land titles from relatively rich and powerful absentee owners to relatively poor squatters-settlers, may increase productivity.

The rest of this paper proceeds as follows: Section 2 provides background on the doctrine of adverse possession and the historical context. Section 3 describes the data and presents the estimation framework. Section 4 is the main part of this paper, in which I present and discuss the empirical results. Subsection 4.1 focuses on agricultural production and subsection 4.2 provides evidence on channels. Section 5 concludes.

2 Background

2.1 Adverse Possession Legal Doctrine

Under the doctrine of adverse possession, individuals may acquire formal title to real property owned by someone else simply by possessing it for a sufficient period of time. In that sense, adverse possession is a method of transferring land ownership outside of formal markets, without the consent of the legal owner and without any compensation. An occupant of land acquires formal title by adverse possession as long as her possession is: (1) Actual and exclusive; (2) Open and notorious; (3) Adverse or hostile to the interests of the true owner under a claim of right; (4) Continuous for the prescriptive period (Netter, 1998).

Landowners who leave their land idle face the risk of having their title transferred to an individual who possess the land continuously and exclusively throughout the statutory period. In order to avoid that risk, absentee owners would have to periodically monitor their land to make sure it is not adversely possessed. The cost and frequency of the required monitoring would depend on the prescriptive period. If indeed some agent occupy the land, the owner will have to appeal to courts for the ejectment of the trespasser and (following the court ruling) the local law enforcement agent, such as the sheriff, will carry out the actual evacuation. If, however, the adverse possessor was in possession throughout the prescriptive period, then the owner stands to lose any right to the land. Moreover, the adverse possessor can himself bring action to quiet title of the original owner.

The historical sources of the doctrine are quite ancient. For example, Sprankling (1994) notes that an ancient form of adverse possession legislation may be found in the 2000 B.C. Code of Hammurabi. In ancient Jewish law, three years of possession of real property is assumed to be sufficient evidence of ownership, which outweighs other claims of ownership, even when those are backed with evidence and testimony.[7]

The origin of adverse possession legislation in British law is the limitation of legal actions - a legislation which precludes one from appealing to courts, even when a legal ground for such an

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[7]See: Baba Batra treatise, Talmud.

appeal exists, since a long period had passed before that person first took legal action. A statute which precludes one from taking legal actions to recover possession of her land first passed in England in the 1272 Statute of Westminster (Patton, 1952). The Act of Limitation with Proviso of 1540 fixed a sixty year period of possession for quieting claims of title (Angell, 1861; Patton, 1952; Wood et al., 1916). Finally, the 1623 Statute of Limitations required that actions to recover possession of real property be brought within twenty years. After twenty years of occupancy any competing claims of ownership would be quiet and precluded. In general, this statute was adopted by the British colonies and particularly by the American colonies (Angell, 1861; Patton, 1952).

Starting in the 1830's, American courts serving the goal of national economic development transformed adverse possession "from a mechanism designed to protect the title of the true owner against false claims into a tool designed to transfer title to wild lands from the idle true owner to the industrious adverse possessor" (Sprankling, 1994, p. 821). Sporadic activities, such as fishing, grazing and gathering firewood were found sufficient in order to establish actual possession in the cases where the true owner left the land idle (Sprankling, 1994). Protecting ones interests in the land became much more difficult and costly. Since acts like occasional fishing is hard to detect, the amount of monitoring that was required in order to protect ones land vastly increased. In this sense, the doctrine limits the security of land titles and de facto conditioned land ownership on the actual use of the land.

Adverse possession legislation currently exists in each of the U.S. states.[8] U.S. adverse possession legislation is not unified and there is variation in the particular requirements within each states. The most notable variation is in the key parameter of the legislation - the prescriptive period, that is, in how long it takes the squatter to acquire formal title to the land via adverse possession. In my sample the prescriptive period varies between 3 to 60 years across states and time (appendix table A.1). I will describe this variation in grater details in section 3.1. Intuitively, a longer prescriptive period implies more secure land rights for absentee owners. To see why, it is helpful to consider the two limiting cases. When the prescriptive period becomes very

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[8]Similar legislation exists in many other countries around the world.

short and approaches zero, property rights in land essentially do not exists. At the other limit, when the prescriptive period approaches infinity, adverse possession legislation essentially do not exists and the rights of absentee owners are perfectly secure.

There are other sources of variations in adverse possession legislation besides the prescriptive period. In some states "color of title" or "good faith" is required in order to gain title through adverse possession, whereas in other states the prescriptive period will be shorter under those conditions. Also, in some states the adverse possessor is required to pay property taxes or cultivate and improve the land throughout the statutory period, while in some others these actions would shorten the prescriptive period. Moreover, in many states certain "disabilities" of the initial formal owner, which prevented her from taking legal action against the adverse possessor, can extend the prescriptive period. Finally, in most states, adverse possession does not apply to lands owned by the sovereign.

2.2   Historical Background

In the nineteenth century, the U.S. expanded to the west and acquired huge tracts of undeveloped land. Initially, the main policy of the states and the federal government was an unrestricted sale of public land into private ownership as a means to raise revenue. This policy, along with expectations of high demand for land in the future, gave rise to massive speculation in land.[9] Speculators acquired enormous tracts of land anticipating the arrival of settlers. So extensive was the speculation in land, that during boom periods huge land holdings become common and whole townships were swept under the control of absentee owners. Many settlers who squatted on public land, in the hope of later obtaining title, saw the land bought by speculators

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[9]The role of land speculation and absentee landlords in the development of the American economy is debatable. Some scholars, such as Paul Gates, takes a very negative view of absentee land ownership. These critics claimed that land speculation and the cash sale of land gave rise to "land monopolization" and a non-democratic ownership structure, and that absentee ownership slowed the development of the west, kept land out of the hands of actual settlers, distorted farmers decisions, reduced tax revenues that were needed in order to supply public goods, such as roads and schools, and increased the tax burden on actual settlers (Gates, 1973; Swierenga, 1977). However, later scholars have pointed to some of the positive aspects of speculators' activities, such as their important function as land retailers, their risk bearing and information roles, their large payments to federal and state governments, and the fact that they helped to attract settlers to the west (North, 1974; Swierenga, 1977). Some have also claimed that speculative profits were in fact modest (Bogue and Bogue, 1957), and that if anything, the correlation between the prevalence of tenant farming and the extent of land speculation is negative (Cogswell, 1975).

(Gates, 1973). Later land policies and legislation, such as the Pre-emption (1841) and the Homestead Act (1862) had little effect on land speculation or the cash sales of land (Gates, 1936).

I use land patents data from the Bureau of Land Management and General Land Office Public Land Records Automation Website in order to plot the total cumulative acres of public land that were distributed via Cash Sale and Railroad Grants and via Homestead (figure 1). The distribution of land by cash sale and railroad grants facilitated absentee ownership and land concentration, while distribution via homestead promoted a more democratic pattern of land holding, in which land is held by many small enfranchised family farms. The figure shows no significant change in the rate of land distributed via cash sale and railroad grants after the enactment of the so called "free land" acts. Only after the year 1920, the end of my sample period, did public land stop being distributed by those means.

Land speculation gave rise to two key patterns of land holdings and land use that are particularly important in the context of this study. First, land ownership was concentrated, as significant shares of the land were owned, at least initially, by absentee owners. Second, squatting was common practice among settlers, both on public land and on private land.[10]

That is not to say that the lion share of the land owned by absentee owners intentionally remained idle for very long periods. Indeed, as Dougless North mentions, "If speculators deliberately held land out of production [...] it would be surprising. The purpose of speculation is to make money, and by following a withholding policy, the speculator would have been doing just the reverse" (North, 1974, p. 126). However, North's theoretical reasoning did not actually realize in all cases. First, many absentee landlords waited for land value to appreciate, sometimes due to improvements made by squatters. Second, since during that time traveling was costly and information was limited and expensive, many absentee owners had to rely on agents. However agents were not always reliable, and smaller investors could not supervise their land matter closely. In many cases, this resulted in their holding becoming tax delinquent with tax titles issued against them. Their unimproved land was commonly plundered by settler

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[10]Squatting on private land was often a result of the fact that land were sometimes sold to private hands with squatters already residing on it

for wood and pasture, or was persistently occupied by squatters (Gates, 1960).

In a setting in which squatting and absentee ownership are common, the risk of losing title incentivized owners to put their land into productive use and gave settlers who lacked resources a mean to obtain title to the land they utilize. In the words of Gates (1962)

> "Adverse possession laws had long been useful to settlers on land claimed by absentee owners who made no improvements, neglected their taxes, and after years of near abandonment tried through court action to recover possession when their holdings were acquiring value."

Due to the controversiality of the legislation, local newspapers had a tendency to report local cases of adverse possession.[11] Basic knowledge of adverse possession legislation was widely spread through newspapers reports on local adverse possession cases, which enabled agents to act upon it. An example of such a report is the October 8, 1891 *Los Angeles Herald's* detailed report of a court decision regrading the local matter of Baldwin vs. Temple, in which the "plaintiff replies upon his paper title and defendant upon title acquired by adverse possession." In addition, "claim associations" formed by squatters sought to advance the interests of squatters and to help them obtain formal title (Gates, 1960). It is very plausible that knowledge regarding adverse possession legislation was also spread through these associations.

In addition to, and partly as a result of, the issue of absentee landlord, land title themselves were not always clear. During the period of westward expansion, formal land titles often conflicted and overlapped. For a variety of reasons, such as inaccuracies in land surveys, Mexican land patents, the issuing of tax titles or acts of frauds and errors, it was not rare for multiple people to hold some legal claim to the same parcel of land.

In this historical context adverse possession was very relevant. Figure (2) plots the historical trend of adverse possession cases.[12] It is clear from this figure that indeed, during my sample

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[11]Using *Chronicling America: Historic American Newspapers* website (The Library of Congress), I found 4,209 newspaper reports containing the phrase "adverse possession" in the U.S. between 1836 and 1922. For comparison, this amounts to roughly 45%, 12% and 5% of the reports containing the phrases "eminent domain," "tax rate," and "public debt," respectively.

[12]I thank Zorina Khan for suggesting looking at the historical trend in legal cases. I use WestLaw Key Number System in order to search of historical court cases involving the legal doctrine of adverse possession in order to construct

period and the era of westward expansion there was a sharp increase in the amount of adverse possession cases, followed by a sharp collapse. It is during the period of westward expansion, when significant share of the public land was being sold for cash to speculators, when many settles were squatting on land they do not own, and when land titles sometimes conflicted and overlapped, that the legislation was particularly important. After Arizona was admitted to the Union in 1912 and the westward expansion formally ended, and after the cash sale of land had ceased and land grants for railroad were no longer given, the importance of the legislation declined.[13]

3 Data and Empirical Strategy

3.1 The Data

Adverse Possession Data. I used HeinOnline *Session Laws Library* and *State Statutes: A Historical Archive* to collect data on the relevant legislation in the 48 contiguous U.S. states and territories between 1840-1930 and constructed a novel dataset of adverse possession prescriptive periods.[14] The dataset documents both first appearances and subsequent changes of the prescriptive periods.

The complete dataset is presented in table A.1 in the appendix. Figure 3 presents a visualization of this dataset in selected years. A darker color implies a longer prescriptive period, that

the data used in this figure. This data should be used with caution, and only in order to document the general historical trend of adverse possession cases. This is because, first, for the historical period the database generally only contains appeal cases, which are a very small and selected sample of cases with distinctive characteristics, compared to the universe of cases. Second, the dates listed in the database are not the dates of the possessory acts, but rather the date of the decision in the appeal case, which is likely to be on average long after the cause of action arose. I sampled 1 percent of cases by state and court type, and whenever it was possible, used the information in the court's decision in order to determine the relevant date from which the prescriptive period started to run. I then used that information in order to correct the dates of all of the cases in the database. Third, the coverage is not homogeneous across states.

[13]Improvements in transportation and telecommunication, which made the monitoring of one's land cheaper, also likely had an effect on the operation relevance of the legislation.

[14]Note that the variations in legislation described in section 2.1 present a challenge for the construction of a unified dataset where the adverse possession prescriptive period is comparable across states and periods. Generally, whenever there where multiple prescriptive periods, I used the one corresponding to an adverse possessor who do not have color of title and do not pay land taxes, which is usually the longer one. In all cases where there was room for interpretation and discretion I used my best judgment.

is, more secure land rights. Notably, the western states in general have a shorter prescriptive period than the eastern states. Presumably, this is a result of squatting and absentee ownership of lands being more prominent in the west.

My identification strategy relies on state-level changes in the prescriptive period in their adverse possession legislation. Figure 4 visualize the changes of the prescriptive period in selected years. A green color implies an increase in the prescriptive period (land rights became more secure) and red implies a decrease. This paper exploits this variation in order to empirically investigate the causal effect of land rights security on economic outcomes in the agricultural sector. 18 states changed their prescriptive period between 1840-1920.[15] In 5 states the prescriptive period changed more than once. In total, there are 23 natural experiments in my panel, out of which 16 are reductions of the period and 7 are increases.

The fact that most legislation changes shortened the prescriptive period, and that states that joined the union later tended to enact legislation with a shorter prescriptive period, resulted in a notable decreasing trend in the average prescriptive period (table A.1). In 1840 the average period was 19.84 years, whereas it was 14.94 years in 1920.

As census data is only available in 10 year intervals, matching adverse possession data to census data is not trivial. In the empirical analysis what is going to matter is whether or not the prescriptive period had changed between census years. However, since information was very slow to diffuse and affect actions in this period, and it also took some time for actions to affect outcomes in the agricultural sector, one might be worried that treating a legislation change which was made one year before the census was taken in the same way as a legislation change that was in effect nine years before the census would add noise to the analysis. Thus, as a robustness check, I will add two different measures of the prescriptive period on top of the straightforward current one. First, as the census years in my sample are taken in 10 years intervals, I would use a natural 5 years lag rule. That is, I will match outcome data from the census to the adverse possession legislation 5 years prior to the census year. As a second alternative

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[15]In two states, Colorado and New Jersey, the legislation changed between 1920-1930. While these "treatments" are outside of my sample period, the periods leading toward them are not. They are therefore included in some specifications which test for pre-trends and the validity of the identification assumption.

measure, I will also use the decade average prescriptive period, in which a legislation change which occurred earlier in the decade would have a stronger effect on the average than a change which took place later on.

Outcomes and Other Data. The economic outcomes which this paper studies are (1) agricultural production; (2) land use; (3) land allocation; (4) investment in farms; and (5) access of mortgage markets. The data on all of these outcome variables is extracted from the U.S. Census of Agriculture (Haines and ICPSR, 2010), and observed at the county level.[16] The U.S. Census of Agriculture is a complete survey of nearly all individual farms within the United States, which was conducted every 10 years between 1840-1920. I use the historical series of national annual CPI from Officer and Williamson (2016) in order to adjust nominal values to real terms (1890 USD).

Over the study period there were significant changes in county borders; some new counties were partitioned from existing counties, and also some areas which were originally a part of one county were assigned to a neighboring county. I follow the procedure in Hornbeck (2010) in order to maintain fixed county definitions, using the data files and code of Perlman (2014). This procedure assumes that the data is geographically uniformly distributed over the county and uses historical county boundaries in order to assign data in each decade to match the county boundaries of some base year. I choose 1890, a midpoint of my panel, as the base year for this process. The results are robust to choosing different base years.

I use the NOAA division of the contiguous U.S. into nine climatically consistent regions (Karl and Koss, 1984) in order to control for region-specific shocks.[17] I use data from Atack (2016) to control for the time-variant presence of railroads in a county.

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[16]In the 1850-1880 agricultural census the individual farm level is available for some counties. Some of those records have been digitized and can be exploited in future research.

[17]The nine climate regions are: central, east north central, northeast, northwest, south, southeast, southwest, west and west north central. See: http://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php

3.2 The Empirical Strategy

I implement two designs in order to estimate the effect of the security of land titles on outcomes in the agricultural sector: a standard fixed effects design and a dynamic difference-in-differences design.

Let me first introduce some notation. **Geographical notation** - let c denote a county (maintaining the 1890 county boundaries) and s denote the state or territory which c belongs to. **Time notation** - let t denote a census year (decades), d denote the first census year after a legislation change and $k = t - d$ denote the year relative to d. **Legislation notation** - let $APPP_{s,t}$ denote the adverse possession prescriptive period in state s at time t and $\Delta APPP_{s,d}$ denote the change in the prescriptive period in state s between periods $d - 1$ and d.

In most specifications I estimate the effect of land rights security using a standard fixed effects design with state-specific time trends:

$$outcome_{c,s,t} = \beta APPP_{s,t} + \gamma_c + \delta_t + \tau_s time + \varepsilon_{c,s,t} \tag{1}$$

where $outcome_{c,s,t}$ is the outcome variable at county c, in state s at year t, γ_c is a county fixed effect, δ_t is year fixed effect, $\tau_s time$ is a state-specific time trend and $\varepsilon_{c,s,t}$ is the error term. The coefficient of interest is β. In some estimations I allow for a non-linear effect of the prescriptive period, and also include the term $(APPP_{s,t})^2$ in equation (1).

Similarly, I estimate the effect in a dynamic difference-in-differences with time trends:[18]

$$outcome_{c,s,t} = \sum_{k=\underline{k}}^{\overline{k}} \beta_k \Delta APPP_{s,d} \mathbb{1}(period_k) + \gamma_c + \delta_t + \tau_s time + \varepsilon_{c,s,t} \tag{2}$$

where β_k is the effect of a one year increase of the prescriptive period in the year k relative to the legislation change, and $\mathbb{1}(period_k)$ is an indicator function that equals one if the relative year is k and zero otherwise.

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[18]Due to the unbalanced nature of my sample, different states are observed for different periods before and after treatment. I choose $\underline{k} = -5^+$ and $\overline{k} = 6^+$ to make sure that each period's coefficient is estimated from more than a minimum of three treated states. The closer to period d the more states that are used in the estimation.

In both designs, the county fixed effects control for all county-level time-invariant characteristics, such as soil fertility, distance from rivers and seas, etc., the year fixed effects control for perfectly correlated nation-wide shocks, such as World War I or the Great Depression, and the state-specific time trends control for different growth trajectories across states. Note that the inclusion of county fixed effects allows for treated and non-treated states (and counties) to have different average levels of the dependent variable. That is to say, I do not assume that all counties would have the same average levels of the dependent variable absent differences in adverse possession legislation. Similarly, the inclusion of state-specific linear time trends allows for treated and control states to have different long-run agricultural trends. The effect of land rights security β is identified off the state-level legislation changes, whereas the identification assumption is that absent treatment, states would remain on their specific long-run trends in periods $k > 0$.

While the treatment varies at the state-year level, I cluster standard errors at the state level, allowing for any arbitrary correlation across counties within a state and over time, in order to address the concerns of serial correlation of outcome variables across years within a state (Bertrand et al., 2004).[19] In order to address the concern of downward biased standard errors as a result of having few clusters, for my main results I also report wild-bootstrapped $p - values$ (Cameron et al., 2008).[20]

3.3 Potential Threats to Identification

There are two main threats to identification: the endogeneity of legislation and the presence of omitted variables.

The endogeneity of legislation. As legislation is a political choice variable, a natural concern is the endogeneity of legislation. The existence of any political economy "feedback effects"

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[19]This level of clustering is more conservative than clustering at the county level or the state-year level. When these levels are used, statistical significance increases in most results.

[20]While there are 48 states in my sample, the number of treated states is 18. Some outcomes are only observed in a limited number of periods, which further reduce the number of treated states in their case. The effective number of clusters is further reduced as a result of the fact that the number of observations (county-years) varies across clusters in my sample (Cameron and Miller, 2015).

17

between current outcomes and future legislation, that are not captured by the other covariates, would violate the conditional strict exogeneity by introducing a correlation between $APPP_{s,t+1}$ and $\varepsilon_{c,s,t}$.

While it does not seem unreasonable that such feedback effects exist, the direction would be ambiguous. The workings of a complicated array of political interests and motivations might result in a positive or a negative bias. For example, it may be argued that when agricultural output is low, political pressure will arise to reduce the level of next period's land rights security, i.e. to shorten the prescriptive period, in order to incentivize higher land utilization. However, it may also be the case that that occurs precisely when agricultural output is high, due to populist demand, or because of the fact that political attention is limited, and only when agricultural output is high incentivizing even higher land utilization seems particularly important (for example, the public is likely to demand higher limitations, regulations, or tax rates on the financial industry when its profits are skyrocketing). Moreover, both arguments may be true to some extent, thus partially cancelling each other out. Therefore, it is not clear in which direction the results might be biased, if they are biased at all.

There are also a few factors mitigating this concern. First, I only observe outcomes at a very low frequency (decades). Policy is less likely to respond to long secular trends in output compared to short or medium-run fluctuations, and shocks that affect the economy at high or medium frequencies are likely to be "washed out" in the data. Moreover, the fact that the prescriptive period is quite stable over time suggests that feedback effects from random, short-run shocks are not significant in influencing legislation. Second, since legislation is determined at the state level, a feedback effect that is sufficient to influence legislation would have to impact many counties in the state simultaneously.

Ideally, the concerns that the bias will generate a false positive (negative) could be directly addressed by studying the dynamics of agricultural production and adverse possession legislation in the spirit of Granger (1969). However, as mentioned above, the fact that the agricultural production is only observed in 10 years intervals somewhat limits the ability to do so, as it is unlikely that legislators' policies target these low frequency movements. Nevertheless, I per-

18

form several exercises in order to try to directly address any remaining concerns. First, as will be discussed below, I analyze the fully dynamic effect of a legislation change. I show that the effect of a legislation change is a sharp non-linear divergence from a flat pre-trend. The dynamic response also suggests that a false-positive estimate as a result of a high or medium frequency cyclical movement of output is unlikely (figure 5). Second, in the fixed affects design, I add to my baseline analysis the lead and lag of adverse possession legislation and find no evidence of political economy feedbacks from output into future legislation (table 1, column 3). Third, I show that at the state level, changes in agricultural output do not Granger-Cause changes in adverse possession legislation (appendix table A.3). I find that the first, second and third lags of changes in agricultural output have no predictive power in forecasting legislation changes, which again suggests that significant political economy feedback are unlikely.[21]

I also take a narrative approach in order to improve the causal inference. Using the limited narrative evidence available, I split legislation changes into two categories: cases where the change to the prescriptive period was carried out by a single act of legislation specific to adverse possession, and the cases in which it was a part of a comprehensive revision of states' codes (see list of legislative changes in Appendix B). Seven out of nineteen states in which the relevant legislation changed belong to the second ("revision") category. The changes in the second group are even more plausibly exogenous than the changes in the first group. A complete revision of a state's code is unlikely to be driven by a desire to boost up a declining agricultural sector, or to directly affect the security of land rights. For the very least, in the "revision" states, the exact timing of the legislative changes is likely to be orthogonal to the pre-trends in agricultural output. Note that as I show in a placebo experiment below, (section 4.1.1), getting the exact decade in which the legislation had changed right matters a lot for the estimation.

In order to understand why these changes are even more plausibly exogenous, it is helpful to have a better understanding of the revision process and to consider a concrete example. The legislative process in the "revision" category usually involved forming legislative committees

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[21]Given the low number of observations per state, the evidence from this exercise should be taken with a grain of salt.

to draft the new code. The committees often borrowed extensively from existing legislation of other states. A prime example is the case of Arizona, in which the prescriptive period had changed in 1901 from 5 to 10 years. In an effort to speed the statehood process, the 20th Arizona Territorial Legislative Assembly authorized creation of a committee "to revise the laws and eliminate therefrom all crude, improper and contradictory matter and also to insert such new provisions as they may deem necessary and proper." (Wagoner, 1970, p. 351). The committee proposed a new code of law. However, rather than drafting an entirely new and original code, the committee based the new code on that of neighboring states. "The civil code was based upon the Texas statutes and the criminal code on that of California" (McClintock, 1916, p. 351). The prescriptive period in Texas's legislation happened to be 10 years, and as a result, Arizona's prescriptive period changed in 1901 from 5 to 10 year. This change was not a result of a political intention to improve the security of land rights in Arizona.

Estimating the effect using only these even more plausibly exogenous legislation change substantially reduces the concern of a bias due to endogeneity. However, since it also reduces the number of legislation changes in my panel by more than half, there is a significant loss of power. As a robustness check, I show that the main result holds when the sample is restricted to only including the revision legislation changes (table 1, column 2). As such, in order to improve efficiency, I use the full sample of legislation changes in my baseline specification.

Omitted variable bias. Another concern is omitted variable bias. Although I control for county fixed effects, aggregate shocks, and state-specific long-run trends in my baseline specification, I do not control for time-varying variables.

One major concern is that many of the changes to adverse possession legislation were coupled with changes to other laws, as explained above. As I do not control for any other legislative change, a natural concern is that my research design does not only "pick-up" the effect of changes in the security of property rights, but rather the effect of an entire bundle of legislation and policies that have changed at once. I deal with this concern by showing that the size and direction of the changes in the prescriptive periods are meaningful. Specifically, I show that increases and decreases in the prescriptive periods have opposite, and quite symmetric, effects, as

20

one would expect if indeed the design picks up the effect of land rights security. This suggests that for my results to be explained by unobserved changes to other laws or policies, it must be the case that increase in the prescriptive periods in my sample are correlated with changes in other policy dimensions, and that these are opposite in their effect to the changes in other policy dimensions that are correlated with decreases in the prescriptive periods. This seems highly unlikely.

The existence of unobserved time-varying factors that affects both legislation and agricultural outcomes is also a concern. One might be particularly worried about local weather shocks and the arrival of railroads. I address the local weather shocks concern in two ways. First, I show that my baseline result is robust to directly controlling for region-specific shocks by replacing the year fixed effects with $ClimateRegion \times Year$ fixed effects. Second, if indeed regional shocks such as weather are driving legislation changes, then we should expect high correlation of legislation changes at a geographical-year level. The geographical and chronological patterns of legislation changes in my sample (figure 4 and table A.1) suggests that that is not the case. Finally, I also show that the result is robust to controlling for the time-variant presence of railroads in the county.

4   Results

4.1   Main Outcome - Agricultural Production

This section studies the relationship between adverse possession prescriptive period and agricultural productivity.

Dynamic difference-in-differences design. I first present results from the dynamic difference-in-differences design (equation 2). Figure (5) presents the dynamic effect of a one year increase in the adverse possession prescriptive period. It plots the regression coefficients (β_{-5+} to β_{6+}) from equation (2) and the associated 90% confidence intervals.[22] The horizontal axis is decades

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[22]Note that the panel is unbalanced around the legislation change dates. That is, in some states many decades are observed before or after a change, and for other only a few decades are observed. The limits of the dynamic

relative to a legislation change and the vertical axis is the estimated effect on the real value of total agricultural production per county acre. I normalize the decade just prior to the legislative change ($k = -1$) to zero.[23]

The results are striking. The trend is flat and linear at least forty years prior to treatment.[24] Following a one-year decrease of the prescriptive period between $k = -1$ and $k = 0$, there is a sharp and significant non-linear divergence of agricultural output from its long-run pre-trend, as the value of agricultural output per county acre increase by a about 3.3 cents ($\beta_0 - \beta_{-1} = 0.033$, the $p - value$ on the null hypothesis that the two coefficients are identical is 0.01). In order to interpret the magnitude of this result, note that the average prescriptive period had declined from 19.42 years in 1840 to 14.94 years in 1920 (table A.1), which amounts to an average increase of $3.3 \times (19.84 - 14.94) \approx 16$ cents in the first decade after a legislation change, or about 5 percent compared to the sample mean of 3.3 dollars. There is a subsequent increase between $k = 0$ and $k = 1$ ($\beta_1 - \beta_0 = 0.016$), followed by a reversion to the trend five decades after treatment. The fact that the trend in the pre-period is flat, and that divergence from the long-run trend only occurs after the legislation, and not before, gives rise to a causal interpretation in the spirit of Granger (1969). Also, the dynamic response does not suggest any business-cycle like cyclical movement of agricultural output at a high or medium frequency that might result in a false-positive estimate in the fixed effects design.

I also address the problem of under identification raised in Borusyak and Jaravel (2016), by which the dynamic causal effect is only identified up to a linear trend, that is, the linear component of the path is not identified. This poses a serious difficulty for the purpose of testing for the absence of pre-trends prior to legislation changes. The issue arises in this specification due to the inclusion of state-specific time trends, which implies that control states are allowed to be on

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analysis $\underline{k} = -5^+, \overline{k} = 6^+$ were chosen such that there the effect for each period is estimated based on more than a minimum of three treated states. Therefore, more credibility should be granted to the estimated coefficients close to the change date, while the estimated effect far away form a legislation change should be taken with a grain of salt.

[23] Note that with the inclusion of county fixed effects, the average levels of the dependent variable are allowed to differ between treated and non-treated counties. Thus, such normalization of the pre-treatment coefficient ($k = -1$) to zero can also be achieved by shifting the estimated county fixed effects accordingly.

[24] The estimated output more fifty years prior to treatment and more appears to be slightly higher, however the difference is not statistically significant, and this coefficient is only estimated off legislation changes in three states.

their on own linear trend. I thus follow the procedure recommended by Borusyak and Jaravel (2016) and restrict the pre-trends by dropping two coefficients $\beta_{k<0}$ from the dynamic effect. Figure A.1 presents the results from this exercise. The dynamic path is almost completely identical to the path estimated in the fully dynamic specification (figure 5). This exercise suggests that the pre-trend is truly flat.

Note that the baseline dynamic difference-in-differences specification above treats increases and decreases of the prescriptive period symmetrically. Rather than pooling together the two types of legislation changes, figure (6) separates the effect into decreases (subfigure a) and increases (subfigure b). This figure makes clear that the effect is symmetric and roughly equal in magnitude; decreases in the security of land titles boost agricultural output by about 5 cents, while depresses increases depresses it by the about same size.[25] This suggests that it is highly unlikely that the results are explained by other legislation or policies changes that occurred at the same time as the changes in adverse possession prescriptive period.

Fixed effects design. I will now turn to my other design - a panel regression with fixed effects and time trends (equation 1). Column 1 of table (1) is my baseline specification. It suggests that a one-year decline in the prescriptive period is associated with an increase of about 5.4 ($SE = 1.5$) cents in the real value of annual agricultural production per acre in the county. The associated $p - value$ is 0.001 and 0.016 using cluster-robust SE and wild bootstrap, respectively. This represents a 1.63 percent increase in production compared to the mean. This result, taken together with the fact that the average prescriptive period in the sample had declined from 19.84 years in 1840 to 14.94 in 1920 (table A.1), suggests that changes in adverse possession legislation had substantial economic impact.

Interpretation. The above results suggest that perfectly secure land titles may slow economic development, compared to ownership that is conditioned upon the actual use of the land. Im-

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[25]The increase coefficients are estimated with lower precision due to the smaller number of cases. Following an increase in the prescriptive period, output drops by $\beta_0^+ - \beta_{-1}^+ = -2.2$ cents in the following decade compared to the long-run pre-trend, and by $\beta_1^+ - \beta_{-1}^+ = -6.1$ cents two decades later, with a $p - value$ of 0.00. Note that the estimated effect 40 years later or more is positive, large and significant. However, as mentioned above, due to the unbalanced nature of the data around legislation changes, this result is estimated off legislation changes in three states, and should thus be taken with a grain of salt.

plicitly, this also suggests that the market for land may fail to achieve a production-efficient allocation of rights in a perfectly secure rights environment. A driver of this failure may be as simple as trade costs or other frictions and imperfections. A shorter prescriptive period in adverse possession legislation, which implies a stricter limitation on the security of the rights of landlords who leave their land idle, may incentivize higher land use. Below (section 4.2.1) I show that indeed, the causal effect of a shorter prescriptive period is an increase in land utilization. This in turn led to higher agricultural production. This is the main result of this paper. The rest of the paper focuses on exploring the robustness of this result and the channels through which it operates.

An important caveat is that the agricultural production-optimal level of land titles protection may be different than the welfare-optimal level. Thus, one should take caution when interpreting these results. First, as the property rights literature suggest, insecure property rights may lead to misallocation of economic resources (Field, 2007; Hornbeck, 2010). Making it "too" easy for a landless agent to obtain title by squatting may distort incentives, causing agents to allocate their labor away from other, and possibly socially preferred, productive activities and into squatting. If this is the case, agricultural production may increase while total output falls. One way I can address this issue is by studying the effects on the manufacturing sector and on urbanization. I do not find any significant effects (table A.2 in the appendix). Second, even in a one-sector economy, in which non-agricultural activities do not exist and the source of market failure is simple trade costs, adverse possession legislation may decrease welfare. Generally, in a simple model of this sort, imposing a limitation on owners' right to keep their land idle may lead to three possible outcomes; (a) the original owner keeps the land idle, but now faces higher costs of protecting his land, which is wasteful; (b) the original owner puts the land to use in order to maintain his title, for example by selling or leasing it; (c) an adverse possessor wins title to the land. It is clear that (a) will decrease welfare. But more interestingly, while in both (b) and (c) output will increase, (b) will actually decrease welfare. To see this, note that this option was available to the original owner under a fully secured property rights regime. By revealed preference, leaving the land idle was preferred. Thus, in this simple setting, only (c), which creates

24

out-of-market reallocation of titles, has the potential to increase aggregate welfare (it will also have a redistributional effect, but this is a different issue). My empirical results above and below seem to suggest that a significant amount of type (b) or (c) occurred, as agricultural production and land use increased, and changes in the allocation of land titles were identified. Narrative evidence points to many cases of type (c) outcomes. Nevertheless, I can not rule out the case that there were some type (a) outcomes, and more generally, I can not speak to the net welfare effect.

4.1.1 Robustness Checks and Placebos

Specification Robustness Checks. In the rest of the columns in table (1) I perform several robustness checks of the main result. In column 2 I drop from my sample all the states in which the change in the prescriptive period was the result of a single act of legislation specific to adverse possession. That is, I only estimate the effect of legislation changes in which I observed a revision of the entire code book. As explained above, these legislation changes are even more plausibly exogenous. The result is robust to that sample restriction, as the point estimate hardly changes.[26] In column 3, I address the concern of reverse causality and political feedback. In the FE design, this concern can be addressed by adding to my baseline specification the lead and lag of adverse possession prescriptive period. The estimated coefficients on both the lag and the lead are statistically indistinct from zero. The point estimate coefficient on the contemporary legislation slightly decreases (in absolute value) compared to the baseline result, but it remains within its 95% confidence interval. This exercise suggests that at the decade frequency, there are no political economy feedback from current agricultural productivity into future adverse possession legislation, and also that there is no effect to be found prior to legislation changes. Columns 4 and 5 add time-varying controls. In column (4) I control for regional specific shocks instead of economy wide shocks, by excluding the year fixed effects and including the NOAA $ClimateRegions \times Year$ fixed effects. The result is robust to this specification as well. This

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[26]Note that while the p-value calculated using cluster-robust SE also does not change much, the wild bootstrap p-value is much higher. Presumably, this is due to the fact that the bias resulting from too few clusters is made worst by this sample restriction.

suggests that the result is unlikely to be driven by unobserved local shocks, such as weather, that are not controlled for. In column 5, I control for the time-variant presence of railroads in the county, using data from Atack (2016). Since this dataset only contains information through 1911, this exercise is in fact a robustness check for both specification and sample selection. The point estimate decreases (in absolute value) compared to the baseline, but this is almost entirely due to the sample selection, and not due to the inclusion of railroads controls (compare with the coefficient when 1920 is excluded in figure 8). Controlling for railroads essentially makes no difference. Columns 6-8 show that the result is robust to using different measures of the prescriptive period and output.

Sample Robustness Checks. I also show that the result is robust to many changes in the sample. First, I show that my results are not driven by just a few outliers. I re-estimate the effect on restricted datasets, excluding each time one single state in which the prescriptive period had changed, in order to make sure that this result is not driven by any one individual state (figure 7). Although there are some minor changes in the point estimates, in all cases they remain negative and economically and statistically significant. I also re-estimate the effect on restricted datasets which exclude each time a single decade, in order to make sure that this result is not driven by any one individual decade. The results are displayed in figure 8. Naturally, in this case the changes in the point estimate are larger, but the point estimates are all negative and statistically and economically significant. I find these results to be reassuring.

Placebos. In addition, I estimate the treatment effect of two placebo treatments in order to validate my result. First, I randomly allocate to each state the adverse possession prescriptive period sequence of another state. That is, I shuffle the adverse possession data between states. I then use this false data in order to re-estimate my baseline specification. I repeat this process 5,000 times in order to obtain the distribution of the estimated coefficient using false simulated data. The outcome of this exercise is presented in figure 9. As expected, the mean (and median) estimated effect is very close to zero. In the simulated data, I obtain a coefficient as small as my estimate in only 0.9 percent of cases. This exercise is another alternative way to do randomization inference on my baseline result, and it suggests a $p-value$ of 0.009.

One might worry that there are some unobserved omitted variables that explain the results, which happen to roughly line up with the changes in adverse possession legislation. In particular, there might be some other factors that cause the states which shortened (extended) the prescriptive period to have high (low) levels of production in the later periods. If this is the case, than the exact decade in which the legislation had changed should not matter. In order to check for this possibility, I run a second placebo test, this time for the decade of the legislation change. For each state in which the prescriptive period had changed, I randomly assign the dates of the legislation changes. I then use this false data in order to re-estimate my baseline regression. I repeat this process 5,000 times in order to obtain the distribution of the estimated coefficient using false simulated data. The outcome of this exercise is presented in figure 10. Two facts are worth highlighting. First, even with perturbations in the decade of the legislative change, the mean and median of the estimated coefficients in this exercise are negative (-0.013 and -0.014, respectively). This seems to further strengthen the hypothesis that on average, a longer prescriptive period reduces long run development. With perturbations of the timing of legislative changes, most of the data is kept unchanged, and particularly, the first and last observations are always left unchanged. Hence, with sufficiently long panel compared to the number of legislation changes (and perturbations of their timing) we should expect that in most cases the effect estimated off the placebo data will have the same sign as the "true" effect. Second, the exact decade in which the legislation changed matters. In the simulated data, I obtain a coefficient as small as my estimate in only 0.4 percent of cases. This suggests that the possibility that the main outcome of this paper is driven by other factors that only happen to roughly line up with the changes in adverse possession legislation, and not by the changes in adverse possession legislation themselves, is highly unlikely.

27

4.2 Channels

4.2.1 Land Utilization

How exactly did a decline in land rights security deliver an increase in agricultural production? I argue that the answer is, mainly by incentivizing higher land use. A reduction of the adverse possession prescriptive period makes it easier for squatters to win title to the land they occupy, and thus increases the risk idle owners are facing. This incentivizes landowners to use their land (as to not lose title), and at the same time, it incentivizes landless individuals to start using someone else's land, in the hope of eventually obtaining title to it. Thus, intuitively, we should expect to find a negative effect of the adverse possession prescriptive period on the amount of land that is used in farms.

The data supports this hypothesis. As shown in column 1 of table (2), while aggregate agricultural output increased in the county (table 1, columns 1 and 8), productivity per acre in farms did not. The estimated coefficient is negative but small and statistically insignificant. Consistent with this claim, columns 2-3 suggest that limiting the rights of owners who do not utilize their land increases the share of land that is employed in farms. Column 2 suggests that a one-year decline of the prescriptive period is associated with about a 1,730 ($SE = 895$) acre increase of land in farms, with an associated $p-value$ of 0.059. In order to interpret the magnitude of this effect, note that the average prescriptive period had declined from 19.42 years in 1840 to 14.94 years in 1920 (table A.1), which amounts to an average increase of $1,730 \times (19.84 - 14.94) = 8,477$ acres, or about 3.7 percent compared to the sample mean of $231,867$ farm acres in a county. In column 3 I estimate the effect on the share of land in farms. The inclusion of county fixed effects in the regression should control for the fact that some counties are, for example, bigger than others, so one generally does not expect results to differ much qualitatively between column 2 and 3. Column 3 suggests a one-year decline of the prescriptive period is associated with a 0.283 ($SE = 0.148$) percentage points increase in the share of county land that is in farms, with associated $p-value$ of 0.061. In order to interpret the magnitude of this effect, note that the average share of land in farms within the sample period is 56.6%, and the average effect amounts

28

to $0.283 \times (19.84 - 14.94) \approx 1.4$ percentage points increase in the share of land in farms.

It is interesting to contrast these results with the results of Goldstein and Udry (2008), who show that in Akwapim, Ghana, insecure land titles lead to over-use of agricultural lands, thereby reducing productivity.

4.2.2 Allocation of Land Titles

By directly transferring land title to adverse possessors, or by incentivizing absentee landowners to sell their holdings, changes in adverse possession legislation might affect the allocation of land titles. I therefore investigate how the number and distribution of land titles changed in response to the legislation. I find that less secure land titles increased the number of owner-cultivated farms and the share of big farms, and decreased the share of very small farms.

In table 3, I show that while there isn't any significant association between the prescriptive period and the number of farms (column 1), adverse possession legislation does seem to affect the share of farms that are cultivated by their owners. Column 2 suggests that a one-year decline of the prescriptive period is associated with a 0.241 ($SE = 0.140$) percentage points increase in the share of cultivator-owned farms in the county, compared to a mean of 70.23. Given the average decline in the prescriptive period within my sample period, this effect amounts to an average of increase $0.241 \times (19.84 - 14.94) \approx 1.2$ percentage points increase. This result however is only marginally significant, with an associated $p - value$ of 0.093.

Adverse possession also affected the size of farms. Column 3 shows that a one-year decline of the prescriptive period is associated with an increase of 3.5 ($SE = 1.6$) acres in the average size of farms in the county, which represents about a 1% increase compared to a mean of 344 acres.

It is important to note that this increase in the average farm size is a result of changes in the distribution of farm sizes. Figure (11) presents the estimated coefficients of adverse possession prescriptive period and the 90% central confidence interval from the fixed effects design (equation 1) where the dependent variable is share of farms in a given size category in the county. For reference and interpretation, figure (12) presents the distribution of farm sizes in the sample,

29

polling over all decades and states. There is no effect on the share of very large farms, i.e. farms in the $1,000+$ and $500 - 999$ acres categories. For the rest of the categories, the coefficient is positive for small farms (below 50 acres), and negative for medium farms ($50 - 500$ acres). More specifically, the coefficient on the share of farms in the $0 - 9$ acres category is 0.21 ($SE = 0.1$), the coefficient on the share of farms in the $10 - 19$ acres category is 0.29 ($SE = 0.09$), the coefficient on the share of farms in the $20 - 49$ acres category is 0.28 ($SE = 0.15$), and the coefficient on the share of farms in the $100 - 499$ acres category is -0.73 ($SE = 0.31$). The coefficient for the $50 - 99$ and $500 - 999$ acres are not statistically significant at conventional levels. This implies that a reduction of land rights security mainly shifted mass from the $0 - 49$ acres categories to the $100 - 499$ acres category. In other words, a decline in the prescriptive period increased the number of mid-sized farms and decreased the number of very small farms.[27]

There are two possible explanations for this pattern. First, a shorter prescription period made it easier for small farmers to increase their land holdings by squatting to adjacent lands. By increasing their holdings, these farmers would have "moved" to a larger farm size category. Second, due to economy of scale, following a reduction in the security of land rights, larger land holders may have found it easier to protect their lands compared to very small owners, and were thus less likely to sale or lose their holdings.

4.2.3 Investment

Changes in adverse possession prescriptive period are likely to affect the investment incentives of both squatters and original landowners. Note that a shorter prescriptive period incentivizes the squatter to invest, even prior to becoming the formal legal owner of the land, since it increases the probability that she will eventually become the formal owner. At the same time, an increase in the probability that a squatter will become the formal owner is an increase in the probability that the original owner will lose her land. This is suggestive of a trade-off between the incentives of original owners and squatters. The results below support that possibility, as

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[27] A farm smaller than 50 acres is indeed very small. For example, the Homestead Act was often criticized for the fact that a farm size of 160 acres is too small, particularly in the Great Plains.

there is also evidence of a hump shaped relationship between land rights security and investment per farm acre.

Column 1 of table (4) suggests that limiting land rights security increases the aggregate investment in machinery in farms in the county. A one-year decline in the prescriptive period is associated with an increase of 0.5 ($SE = 0.3$) cents in the real value of farm equipment per county acre, compared to an average value of 63 cents over the period 1850-1920. While this is a sizable economic effect (about 0.8 percent of the mean), it is only marginally significant, with an associated $p - value$ of 0.09. However, column 2 suggests that investment per acre in farms did not increase. That is, the capital to land used ratio did not increase. It is thus possible that the increase in aggregate investment is a direct result of the fact that more land was employed. Column 3 suggests that the relationship between land rights security and investment in utilized land is hump shaped. This might be a consequence of two offsetting effects: a positive effect on investments by squatters and a negative effect on investment by original owners. The estimated coefficients on the first and second degree terms allows me to calculate the turning point, that is, the optimal prescriptive period which will maximize investment in equipment - $\frac{0.04063}{2 \times 0.00125} \approx 16.24$ ($SE = 1.74$) years. The 95% confidence interval of the turning point is $[13.4, 19.1]$ years.

Columns 4-7 focus on agricultural investment in land irrigation.[28] Here two the strongest results are the ones suggesting a trade-off between the incentives of squatters and original owners (columns 5 and 7). It is interesting to note though, that while there is no statistically significant effect on the share of county land that is irrigated (column 4), the effect of a decrease in security of land rights on the share of farmland that is irrigated is negative. The difference between the results on equipment and irrigation could be a result of the fact that, unlike investment in irrigation, investment in equipment is not permanently attached to the land and it is relatively reversible.

It is interesting to compare this set of results with those of Galiani and Schargrodsky (2010),

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[28]Unlike the value of equipment, land irrigation data is only observed in four decades. The estimation with respect to these outcomes are thus only estimated off a few legislation changes, and should thus be taken with a grain of salt.

who find that formal land title given to squatters had a positive effect on housing investment.

Finally, column 8 suggests that lower level of security of land titles might have increased the access of some farmers to capital markets. A one-year decline of the prescriptive period is associated with a 0.5 percentage points increase in the share of farms with mortgage, compared to a mean of 19.9 percent.[29] The farmers whose access to capital markets improved as a result of a lower prescriptive period were presumably squatters. Indeed, a reduction in the security of titles of absentee owners increases the squatters' chances of becoming formal owners. This result adds an interesting perspective to the existing literature on land titles and access to financial markets (De Soto, 2000; Field and Torero, 2008; Galiani and Schargrodsky, 2010; Wang, 2012).

5   Conclusion

The broad message of this paper is that the relationship between property rights and economic development can be quite complex and dependent on the specific economic and historical context. Following evidence showing that secure property rights are important for economic development, this paper explored the possibility of land titles being *over secure*, i.e. that the optimal level of security may not be the fullest one. Weaker property rights *a-la* adverse possession legal doctrine may facilitate redistribution of land titles from relatively rich and powerful owners to relatively poor farmers.[30] Under some circumstances, this redistribution will be more efficient than the initial allocation that would persist under a fully secure property rights regime. My hypothesis is that such a design will be beneficial when there is relatively high inequality.

Historical changes to adverse possession legislation within U.S. states and territories during the period of westward expansion created a setting in which this possibility can be empirically explored. By studying the effects of adverse possession prescriptive period, this research has demonstrated that perfectly secure land rights may actually reduce economic efficiency. The data show that during the American Westward Expansion, imposing a stricter limitation on

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[29]Mortgage data too is only observed in four decades. This estimation should thus also be taken with a grain of salt.
[30]Note that I am not referring to expropriation risk by the elite, which is another form of weak and insecure property rights that is distinct from adverse possession, and has been the focus of many papers.

landowners' rights to leave their land idle by setting a shorter prescriptive period increased agricultural production. The main driving force behind this increase in output seems to be higher land use on the extensive margin, as productivity per land unit used did not increased. This study has also shown that less secure land titles were associated with higher aggregate investment in equipment in farms, better access of farmers to capital, and changes in land allocation, with an increase in the share of cultivator-owned farms and the share of mid-size farms.

While this project focused on the past, it may indeed teach a very general lesson; that, from the view point of economic development, institutions that condition private ownership upon use *a-la* adverse possession may be superior to institutions in which property rights are always protected. This lesson may still be policy-relevant today. It is well known that land inequality is particularly high in many developing countries. This form of inequality is often linked to low productivity and growth rates. Policies and legislation similar to U.S. adverse possession may still be effective in enhancing economic efficiency in many developing countries. Moreover, land ownership structure, and particularly, land inequality, land concentration and absentee ownership, are still a central issues in many developed countries. For example, in 2014 in the United States, 39 percent of agricultural land was rented, of which 80 percent was owned by non-farming landlords - individuals, partnerships, corporations, trust or others (USDA, 2014 TOTAL). In some U.S. counties in 2012, the share of farmland leased or rented exceeds 60 percent (USDA NASS, 2012 Census of Agriculture). Finally, this lesson may also apply to patent laws. It may be efficiency enhancing to restrict patent owners from "sitting" on their patent while blocking others from using it for the general good. Indeed, patent laws often given the sovereign the power to require a patent holder to put his patent to use. Studying the optimal balance between security and flexibility of property rights in today's environment thus seems a promising avenue for future research

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Table 1: Agricultural Production

	Dependent variable: Agricultural Production							
	per County Acre							County Total
	Baseline	Identification		Controls		Measurement		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Adverse Possession Prescriptive Period	-0.054*** (0.015) [0.0160]	-0.057*** (0.015) [0.0836]	-0.046** (0.017) [0.0144]	-0.045*** (0.013) [0.0392]	-0.036** (0.013) [0.0180]			-18,536.20* (7,325.96) [0.0232]
Lagged Prescriptive Period			-0.035 (0.021)					
Lead Prescriptive Period			0.002 (0.035)					
Decade Average Prescriptive Period						-0.072*** (0.012) [0.0032]		
5 Years Lag Prescriptive Period						-0.044*** (0.012) [0.0060]		
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
State Trends	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Climate Region X Year	No	No	No	Yes	No	No	No	No
Railroads	No	No	No	No	Yes	No	No	No
Observations	21,165	15,627	18,053	21,165	18,382	20,211	20,645	21,165
R-squared	0.901	0.905	0.913	0.905	0.907	0.905	0.903	0.863
Dep. Var. Mean				3.300				1,236,871

Note: The dependent variable in columns (1)-(7) is the real value of total agricultural production per acre in the county, and in column (8) it is the total real value of agricultural production in the county. Observations are at the county-decade level and the time units are decades. State level cluster-robust standard errors in parentheses. Wild bootstrapped (5,000 repetitions) p-values clustered at the state level in brackets. $^{+} p < 0.10$, $^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Table 2: Channels: Land Use

	Agricultural Production	Land in Farms	
	per Farm Acre	Acres in County	% of County
	(1)	(2)	(3)
Adverse Possession	-0.0230	-1,730.00+	-0.283+
Prescriptive Period	(0.0292)	(894.71)	(0.148)
County FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
State-Specific Trends	Yes	Yes	Yes
Observations	19,562	19,575	19,575
R-squared	0.698	0.855	0.973
Dep. Var. Mean	5.829	231,867	56.570

Note: The dependent variable in column (1) is the real value of total agricultural production per acres in farms, in column (2) it is acres in farms in county and in column (3) it is the share of county land in farms. Observations are at the county-decade level and the time units are decades. Standard errors in parentheses are clustered at the state level. $^+ p < 0.10, ^* p < 0.05, ^{**} p < 0.01, ^{***} p < 0.001$

Table 3: Channels: Land Allocation

|	# Farms	% Farmer Owned	Avg. Farm Size
		Dependent variable:	
	(1)	(2)	(3)
Adverse Possession	-0.267	-0.241+	-3.516*
Prescriptive Period	(10.608)	(0.140)	(1.643)
County FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
State-Specific Trends	Yes	Yes	Yes
Observations	19,504	13,399	19,292
R-squared	0.936	0.993	0.810
Dep. Var. Mean	1,598.62	70.234	343.61

Note: The dependent variable in column (1) is the number of farms in county, in column (2) it is share of farms cultivated by owners in the county, and in column (3) it is the average size of farms in the county. The distribution of farm size is highly skewed, with a small number of extremly big farms. The regression reportaed in column (3) drops from sample the counties at the top 1 percent of the average farm size distribution. Observations are at the county-decade level and the time units are decades. Standard errors in parentheses are clustered at the state level. $^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Channels: Investment and Access to Capital Markets

|	Dependent variable:							
	Equipment Value			% Irrigated				% With Mortgage
	per county Acre	per Farm Acre		per County Acre		per Farm Acre		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Adverse Possession Prescriptive Period	-0.005+ (0.003)	0.001 (0.005)	0.041* (0.020)	-0.007 (0.018)	0.266+ (0.143)	0.225+ (0.127)	2.465+ (1.232)	-0.512* (0.207)
Prescriptive Period^2			-0.001* (0.001)		-0.011+ (0.006)		-0.092+ (0.050)	
Turning Point			16.24*** (1.74)		11.90*** (0.86)		13.45*** (0.90)	
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,555	19,555	19,555	1,126	1,126	1,126	1,126	10,979
R-squared	0.907	0.634	0.634	0.834	0.835	0.902	0.903	0.931
Dep. Var. Mean	0.634	1.072		1.979		14.193		19.907

Note: The dependent variable in columns (1)-(3) it is the value of equipment in farms, in columns (4)-(7) it is the share of that is irrigated, and in column (8) it is the share of farms with mortgage. Observations are at the county-decade level and the time units are decades. Turning Point is an estimate for the investment maximizing prescriptive period for the cases in which the coefficient on the quadratic term is significant. Standard errors in parentheses are clustered at the state level. $^+ p < 0.10$, $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Figure 1: The Distribution of Public Lands
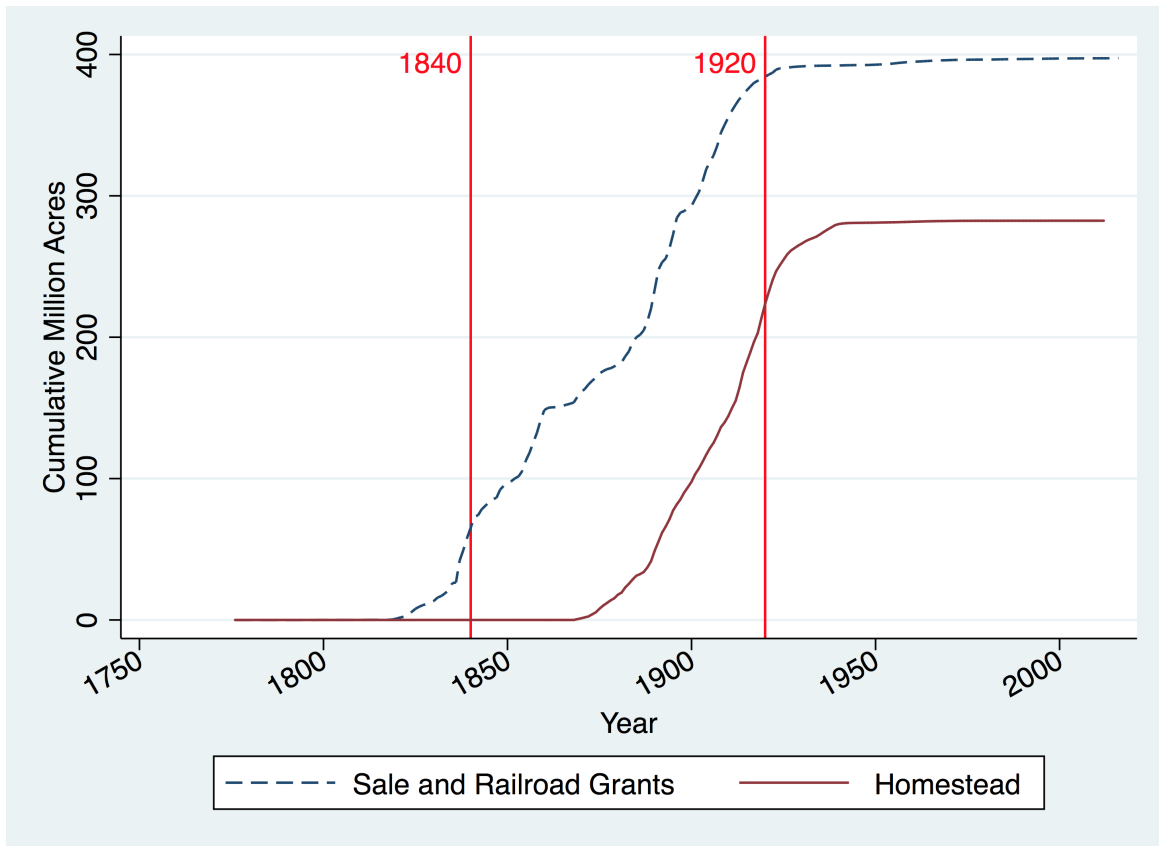
Note: This figure use land patents data from the Bureau of Land Management and General Land Office Public Land Records Automation Website in order to plot the total cumulative acres of public land that was distributed according to major means of distribution. The dash line plots the cumulative acres distributed via Cash Sale and Railroad Grants, and the solid line plots the cumulative acres distributed via Homestead.

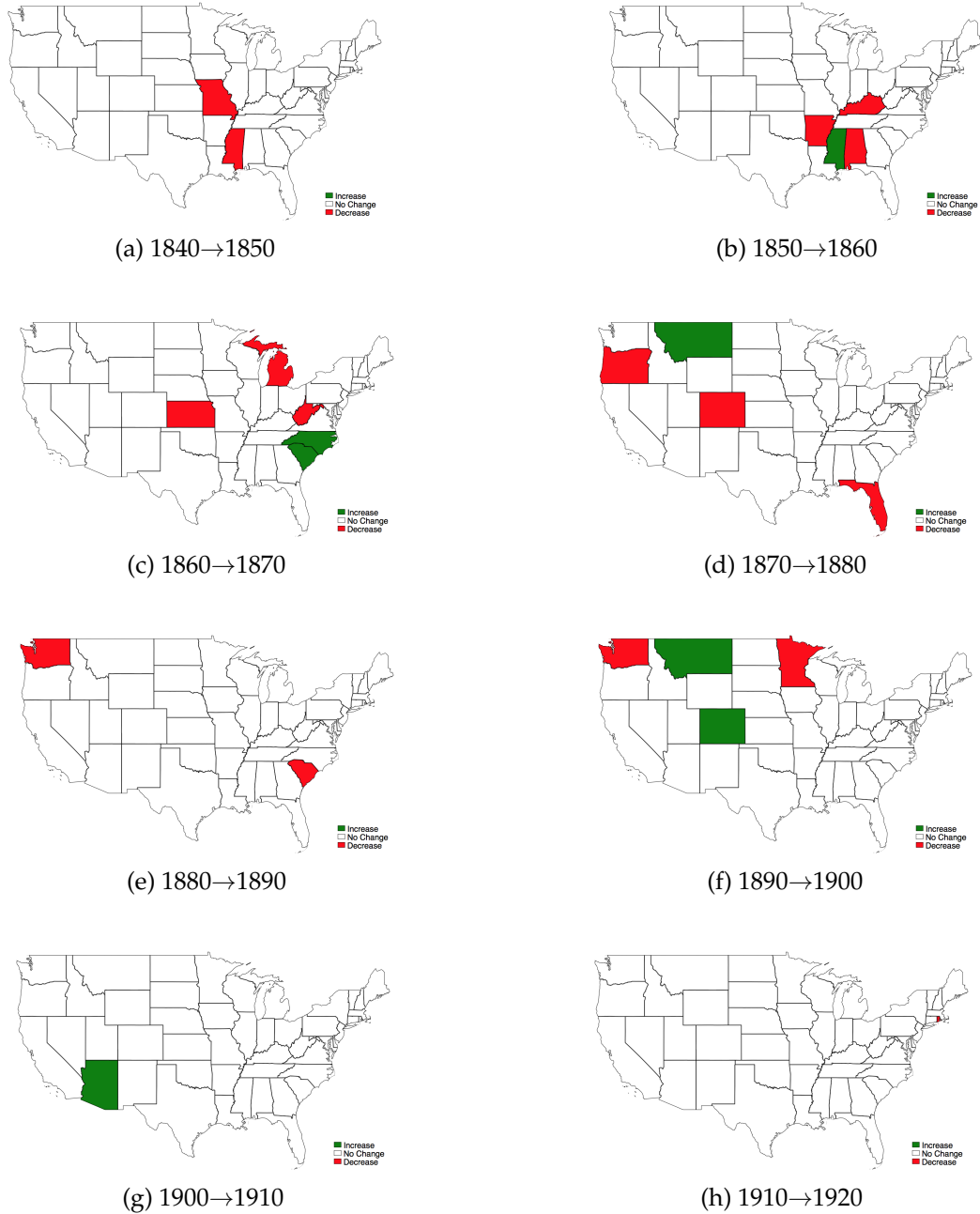Figure 2: Historical Trend of Adverse Possession Cases
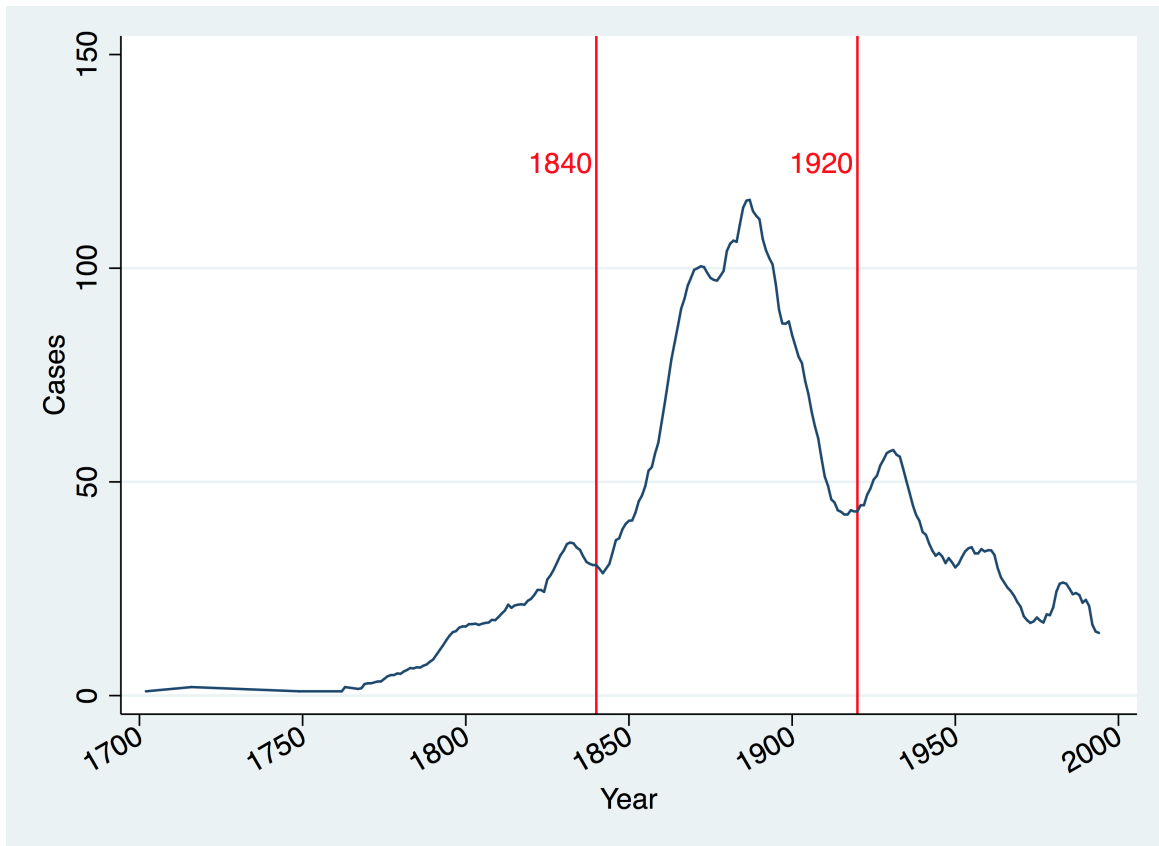
Note: This figure presents the historical trend of adverse possession cases. I use WestLaw Key Number System in order to search of historical court cases involving the legal doctrine of adverse possession in order to construct the data used in this figure. The database generally only contains appeal cases. That is, a small and selected sample of cases with distinctive characteristics compared to the universe of adverse possession cases. The dates listed in the database are the dates of the decision in the appeal case, and not the dates in which the cause of action arose. To get a proxy for the historical trend in adverse possessory acts, I sampled 1 percent of cases by state and court type, and whenever it was possible, used the information in the court's decision in order to determine the relevant date from which the prescriptive period started to run. I then used that average in-sample gap between the date of the possessory act and the date of the court decision, 20.06 years, in order to correct the dates of all of the cases in the database.

Figure 3: Adverse Possession Prescriptive Period in Selected Periods

(a) 1840

(b) 1850

(c) 1860

(d) 1870

(e) 1880

(f) 1900

(g) 1910

(h) 1920
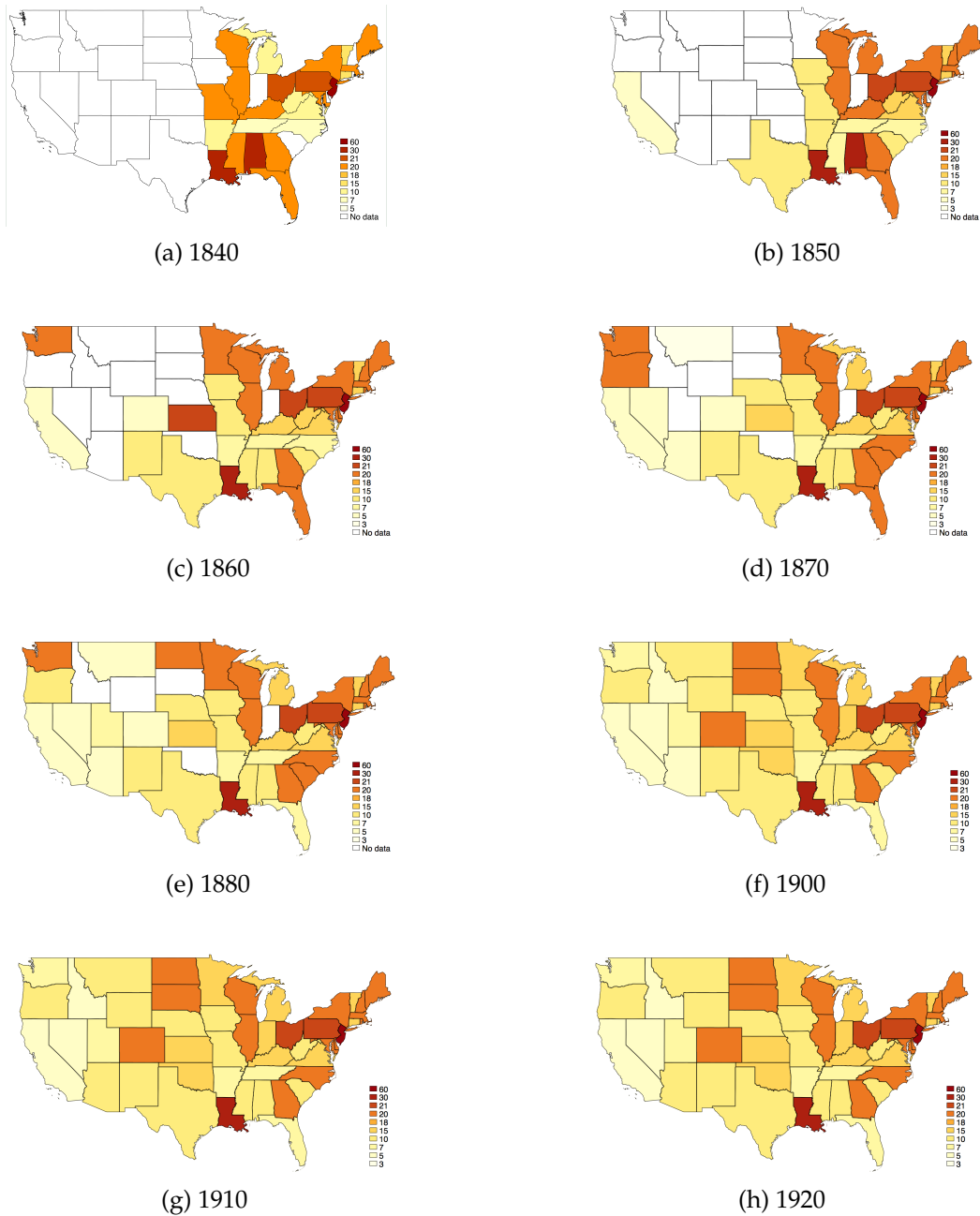
Note: This figure presents the adverse possession prescriptive period in selected years. The data presented was constructed by the author from numerous legal sources, and is subject to further review. For the complete list of adverse possession prescriptive periods across U.S. states between 1840-1930, see table A.1 in the appendix.

Figure 4: Changes to Adverse Possession Prescriptive Period

(a) 1840→1850

(b) 1850→1860

(c) 1860→1870

(d) 1870→1880

(e) 1880→1890

(f) 1890→1900

(g) 1900→1910

(h) 1910→1920

Note: This figure presents changes to the adverse possession prescriptive period in selected years. The data presented was constructed by the author from numerous legal sources, and is subject to further review. For the complete list of adverse possession prescriptive periods across U.S. states between 1840-1930, see table A.1 in the appendix.

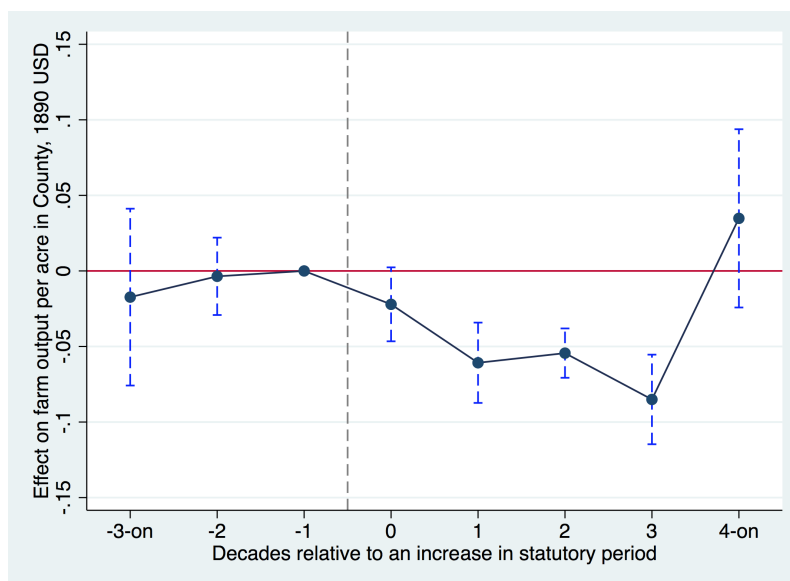Figure 5: The Dynamic Effect of Changes to Land Rights Security
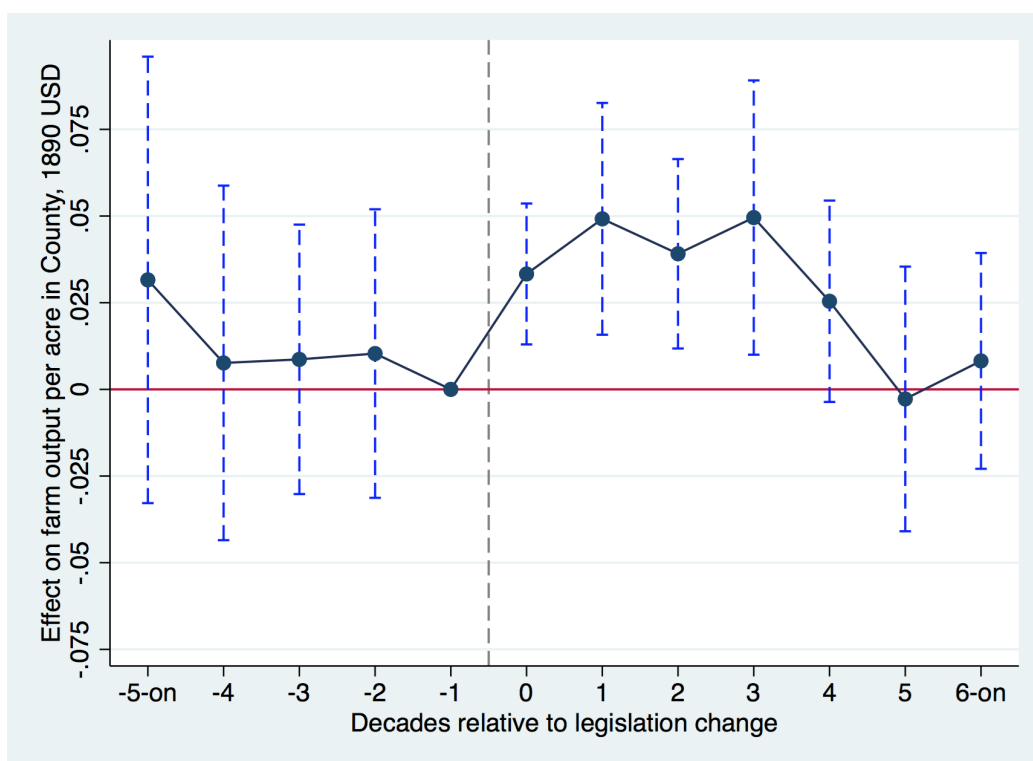
Note: This figure presents the dynamic effect of a one year decrease in the adverse possession prescriptive period, by plotting the regression coefficients and associated 90% confidence intervals for the treatment effect in a given year k relative to legislation change, i.e., the β_k from the dynamic difference-in-differences specification. The estimation treats increases and decreases of the prescriptive period symmetrically. Standard errors are clustered at the state level. The horizontal axis is decades relative to a legislation change and the vertical axis is estimated effect on the real value of total agricultural production per acre.

Figure 6: The Dynamic Effect of Changes to Land Rights Security
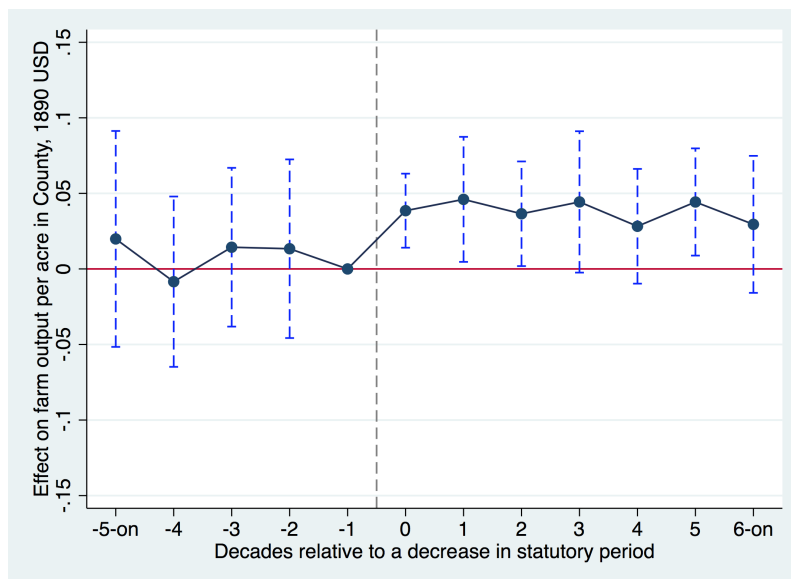
(a) A Decrease in Prescriptive Period

(b) An Increase in Prescriptive Period

Note: These figures present the dynamic effect of a one year decrease (a) and increase (b) in the adverse possession prescriptive period, by plotting the regression coefficients and associated 90% confidence intervals for the treatment effect in a given year k relative to legislation change, i.e., the β_k from the dynamic difference-in-differences model in which increases and reductions of the prescriptive periods are considered as different treatments. Standard errors are clustered at the state level. The horizontal axis is relative to a legislation change and the vertical axis is estimated effect on the real value of total agricultural production per acre.

Figure 7: Robustness Check of Baseline Estimation - Specific States
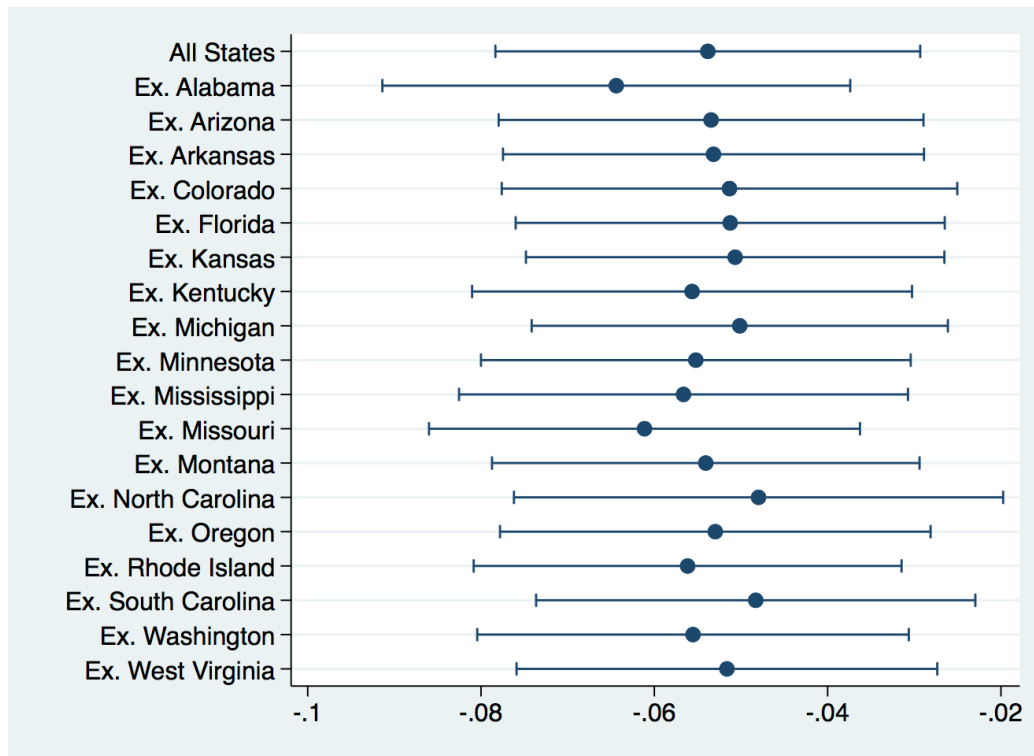
Note: This figure presents the estimated coefficient of adverse possession prescriptive period and the 90% central confidence interval (standard errors are clustered at the state level) from a regression in which the dependent variable is the real value of total agricultural production per acre in county. County fixed effects, year fixed effects and state-specific time trends are also controlled for. The top line uses all states in the database and corresponds to column (1) in Table 1. All other lines excludes from the database one state in which the prescriptive period had changed.

Figure 8: Robustness Check of Baseline Estimation - Specific Decades
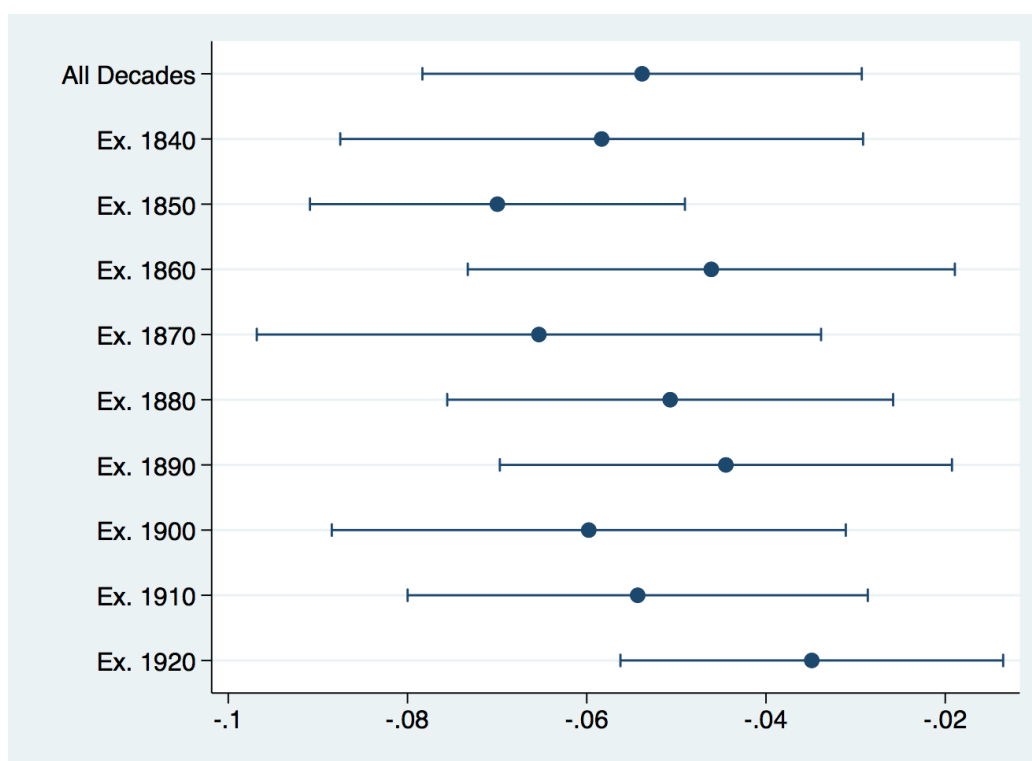
Note: This figure presents the estimated coefficient of adverse possession prescriptive period and the 90% central confidence interval (standard errors are clustered at the state level) from a regression in which the dependent variable is the real value of total agricultural production per acre in county. County fixed effects, year fixed effects and state-specific time trends are also controlled for. The top line uses all decades in the database and corresponds to column (1) in Table 1. All other lines excludes from the database one decade at a time.

Figure 9: Placebo - Reallocate Legislation Time Series Across States
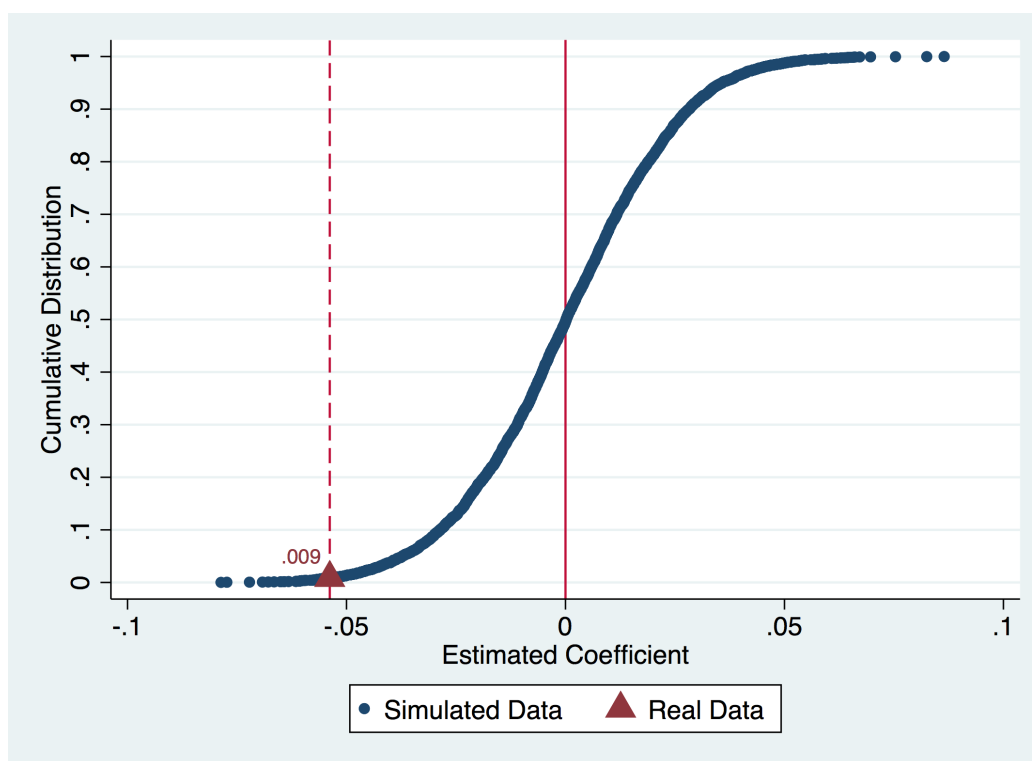
Note: This figure presents the distribution of the estimated coefficient on adverse possession prescriptive period using simulated data. I randomly reallocate the adverse possession prescriptive period time series data across states. I then use this false data in order to estimate my baseline regression, in which the dependent variable is the real value of total agricultural production per acre in county, where county fixed effects, year fixed effects and state-specific time trends are also controlled for, and obtain the coefficient of adverse possession prescriptive period. I repeat this process 5,000 times in order to obtain the distribution of the estimated coefficient using simulated data.

Figure 10: Placebo - Random Date for Legislation Change
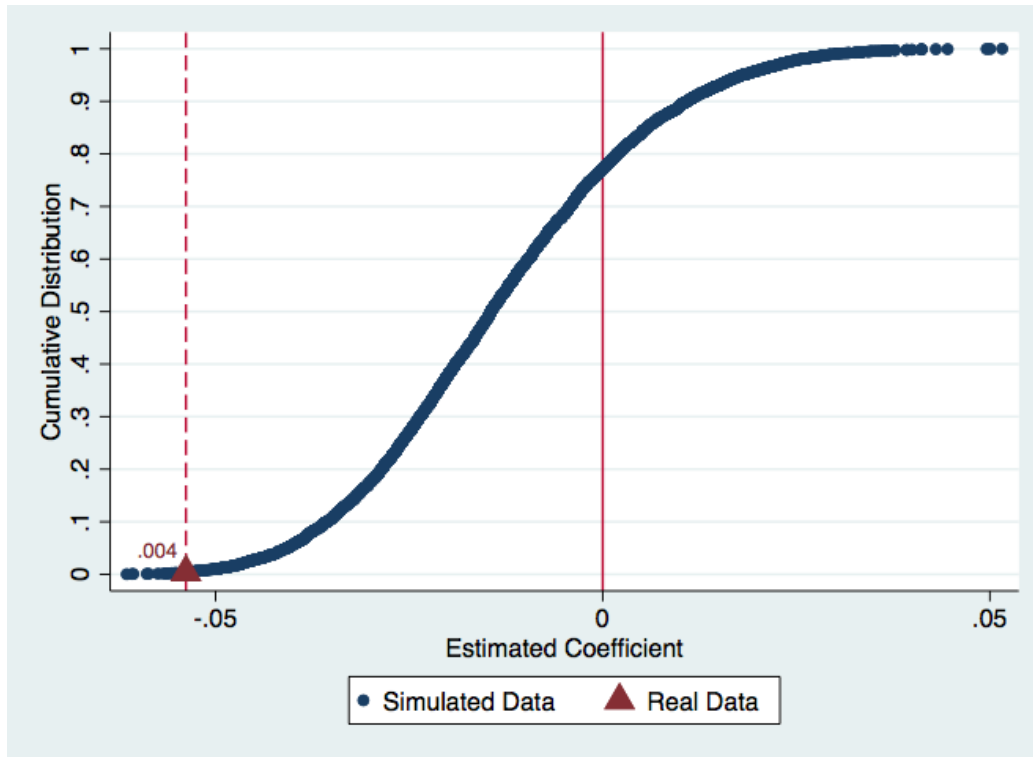
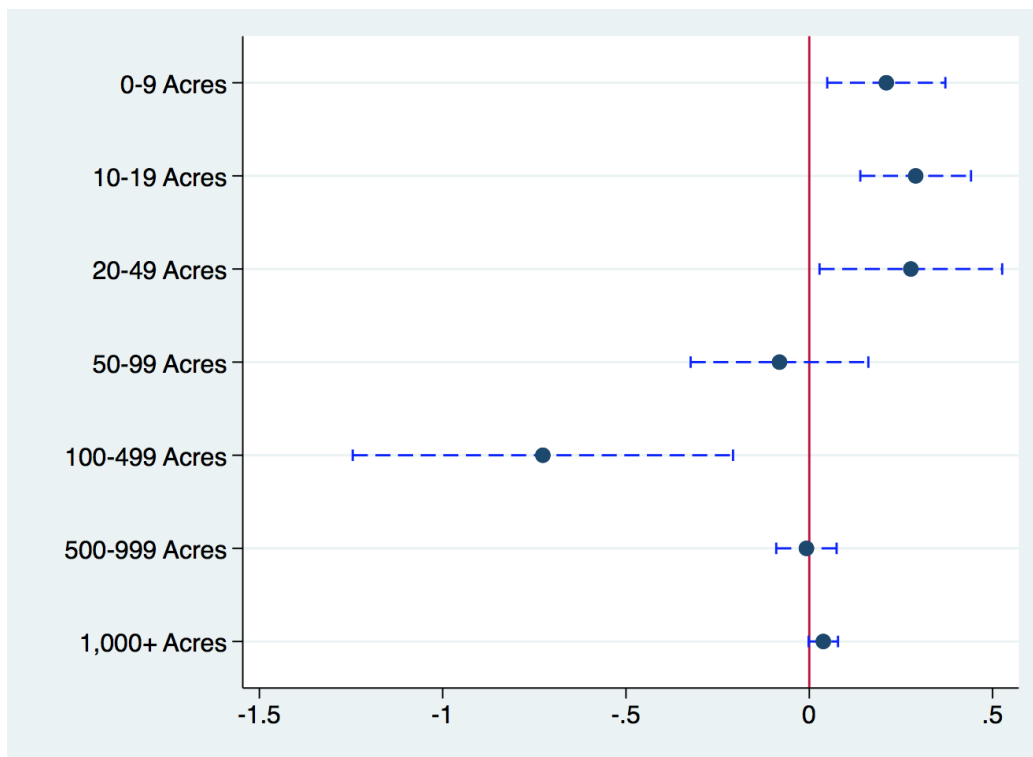

Note: This figure presents the distribution of the estimated coefficient on adverse possession prescriptive period using simulated data. For each state in which the prescriptive period had changed within the sample period, I randomly assign the dates of the legislation changes. I then use this false data in order to estimate my baseline regression, in which the dependent variable is the real value of total agricultural production per acre in county, where county fixed effects, year fixed effects and state-specific time trends are also controlled for, and obtain the coefficient of adverse possession prescriptive period. I repeat this process 5,000 times in order to obtain the distribution of the estimated coefficient using simulated data.

Figure 11: Land Rights Security and the Distribution of Farm Sizes

Note: This figure present the estimated coefficients of adverse possession prescriptive period and the 90% central confidence interval (standard errors are clustered at the state level) from a regression in which the dependent variable is share of farms of a given size category in the county. County fixed effects, year fixed effects and state-specific time trends are also controlled for.

Figure 12: The Distribution of Farm Sizes
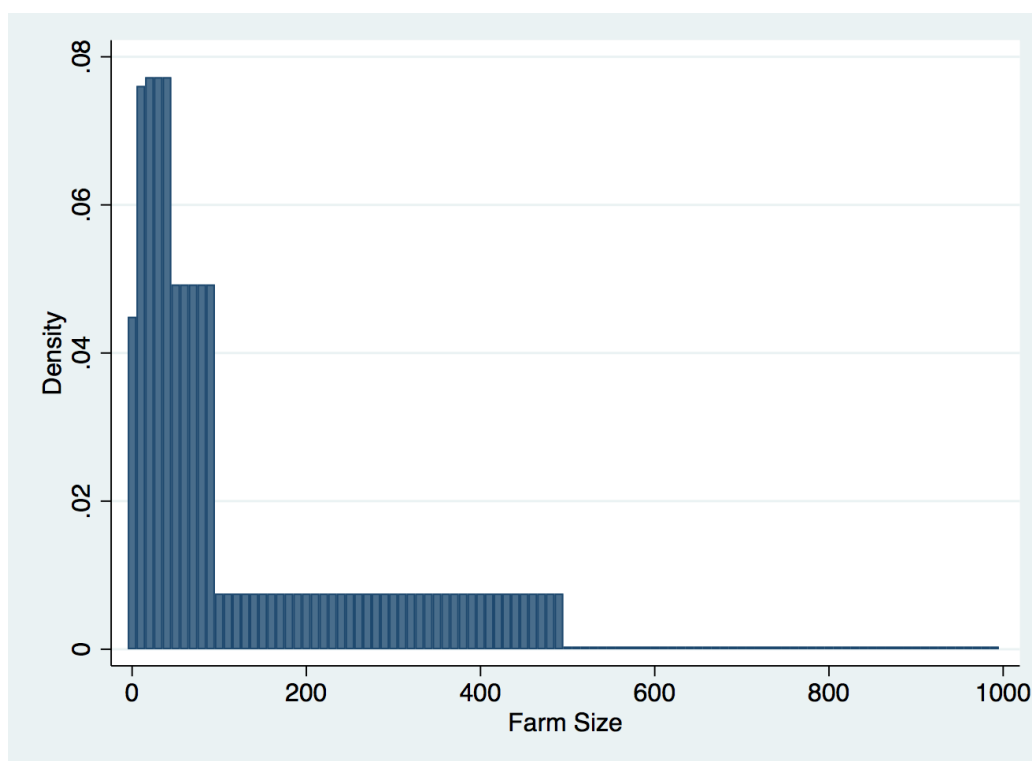
Note:This figure present the distribution of farm sizes in the sample, polling over all decades and states. Data take the form of the number of farms in each size category, 0-9 acres; 10-19 acres; 20-49 acres; 50-99 acres; 100-499 acres; 500-999 acres; and 1000+ acres, in each county-year.

A   Appendix - Adverse Possession Prescriptive Periods

Table A.1: Adverse Possession Prescriptive Period, 1840-1930

State	1840	1850	1860	1870	1880	1890	1900	1910	1920	1930
Panel A: States in Which the Legislation has Changed										
Alabama	30	30	10	10	10	10	10	10	10	10
Arizona				5	5	5	5	10	10	10
Arkansas	10	10	7	7	7	7	7	7	7	7
Colorado			6	6	5	5	20	20	20	18
Florida	20	20	20	20	7	7	7	7	7	7
Kansas			21	15	15	15	15	15	15	15
Kentucky	20	20	15	15	15	15	15	15	15	15
Michigan	20	20	20	15	15	15	15	15	15	15
Minnesota			20	20	20	20	15	15	15	15
Mississippi	20	7	10	10	10	10	10	10	10	10
Missouri	20	10	10	10	10	10	10	10	10	10
Montana				3	5	5	10	10	10	10
New Jersey	60	60	60	60	60	60	60	60	60	30
North Carolina	7	7	7	20	20	20	20	20	20	20
Oregon				20	10	10	10	10	10	10
Rhode Island		20	20	20	20	20	20	20	10	10
South Carolina	10	10	10	20	20	10	10	10	10	10
Washington			20	20	20	10	7	7	7	7
West Virginia	15	15	15	10	10	10	10	10	10	10

State	1840	1850	1860	1870	1880	1890	1900	1910	1920	1930
Panel B: States in Which the Legislation have Not Changed										
California		5	5	5	5	5	5	5	5	5
Connecticut	15	15	15	15	15	15	15	15	15	15
Delaware			20	20	20	20	20	20	20	20
Georgia	20	20	20	20	20	20	20	20	20	20
Idaho						5	5	5	5	5
Illinois	20	20	20	20	20	20	20	20	20	20
Indiana						15	15	15	15	15
Iowa		10	10	10	10	10	10	10	10	10
Louisiana	30	30	30	30	30	30	30	30	30	30
Maine	20	20	20	20	20	20	20	20	20	20
Maryland	20	20	20	20	20	20	20	20	20	20
Massachusetts	20	20	20	20	20	20	20	20	20	20
Nebraska				10	10	10	10	10	10	10
Nevada				5	5	5	5	5	5	5
New Hampshire		20	20	20	20	20	20	20	20	20
New Mexico			10	10	10	10	10	10	10	10
New York	20	20	20	20	20	20	20	20	20	20
North Dakota					20	20	20	20	20	20
Ohio	21	21	21	21	21	21	21	21	21	21
Oklahoma							15	15	15	15
Pennsylvania	21	21	21	21	21	21	21	21	21	21
South Dakota						20	20	20	20	20

Table A.1: (continued)

State	1840	1850	1860	1870	1880	1890	1900	1910	1920	1930
Tennessee	7	7	7	7	7	7	7	7	7	7
Texas		10	10	10	10	10	10	10	10	10
Utah					7	7	7	7	7	7
Vermont	15	15	15	15	15	15	15	15	15	15
Virginia	15	15	15	15	15	15	15	15	15	15
Wisconsin	20	20	20	20	20	20	20	20	20	20
Wyoming						10	10	10	10	10
Average	19.84	17.93	16.94	16.10	15.47	14.79	15.04	15.15	14.94	14.27

Note: This novel dataset was constructed by the author from numerous legal sources and is subject to further review.

B   Appendix - Adverse Possession Legislative Changes

Alabama. An Alabama statute of the Limitation of actions (1802) determined that real and possessory actions to lands are limited to 30 years after the cause of action accrued, and not after[31] (Laws of Alabama 1833, Ch. 11 §75; Laws of Alabama 1843, Ch. 11 §85). On 1850, the general assembly of Alabama appointed a commission to prepare a Code of the Statutes of Alabama (Acts 1850-1851, No. 8, pp. 43-44). The code wad adopted in 1852. Chapter 21 of the code limits all actions for the recovery of lands or the possession thereof to ten years after the cause of action has accrued (Alabama code 1852, §2476; Alabama code 1867, §2900; Alabama code 1876, §3225; Alabama code 1887, §2614; Alabama code 1897, §2795; Alabama code 1907, §4834; Alabama code 1923, §8943).[32]

Arizona. Chapter 35 of the "Howell Code", adopted by the first legislative assembly if the Territory of Arizona, 1864, limits all action for the recovery of real property or the possession thereof to 5 years and determine a 5 years prescriptive period for adverse possession (1865, Ch. 35, pp. §3, 6, 9,10, pp. 254-255; 1871, Ch. 35, §3, 6, 9, 10, pp. 331-332; 1877, Ch. 35, §2083, 2086, 2089, 2090, pp. 356-358). In an effort to speed the statehood process, the 20th Arizona Territorial Legislative Assembly authorized creation of a committee "to revise the laws and eliminate therefrom all crude, improper and contradictory matter and also to insert such new provisions as they may deem necessary and proper." (Wagoner, 1970, p. 351). The committee proposed a new code of law. "The civil code was based upon the Texas statutes and the criminal code on that of California" (McClintock, 1916, p. 351). As a result, Arizona's prescriptive period for adverse possession of lands held without deed was amended to 10 year (R.S. 1901, §2938, p. 771; R.S. 1913, §698, p. 338; R.S. 1928, §2051, p. 497).

Arkansas. Chapter 1 of the Revised Statutes of the state of Arkansas, approved and in force by the general assembly on March 3, 1838, limits actions for the recovery of lands or the possession thereof to 10 years (R.S. 1837, Ch. 91, §1, p. 527; 1846, Ch. 91, §1, p. 695). The Act of January 4,

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[31] Right of entry is limited to 20 years.

[32] A note to this statute in the 1940 code notes: "Analogous to statute of adverse possession. The ten-year statute of limitations as to real actions and the statute of adverse possession, §828 of this title, are to same end and purpose. Drummond v. Drummond, 232 Ala. 401, 108 So. 428." (Code 1940, Title 7, notes to §20, p. 20).

1851 amend the law to 7 years limitation (Acts 1851, p. 145-146; Ch. 106, §2, p. 749, 1937, Ch. 102, §8918, p. 2261).[33].

Colorado. The civil code of Jefferson Territory of 1859, sets a 6 years limitation on actions for the recovery for use and occupation of real property (1859, Ch. 42, §448). The act for the limitation of actions, approved on November 5, 1861 in the first session of the legislative assembly of the Territory of Colorado, have no limitation on acts to recovery possession of land, but do set a 6 years limitations on all action for waste and trespass on land (1861, p. 341; 1867, Ch.55, §1, p. 438). According to "An Act limiting the time for brining actions respecting real estate," approved February 13th, 1874, "every person in the peaceable and undisputed possession of lands [...] under claim and color of title, made in good faith, [...], who shall, for five successive years hereafter continue in such possession, and shall also, during said time, pay all taxes legally assessed [...] shall be held and adjudged to be the legal owners of said lands" (Laws 1877, §1694). Subsequent act of 1893 is borrowed from Illinois, (1935 Colorado Statutes Annotated, Ch.40, comments to §143). It increased the prescriptive period for a possession under color of title and payment of taxes to seven years, but also set a twenty years limit of all actions for the recovery of lands (Laws 1893, Ch.118). This limitation was reduced to 18 years on March 28, 1927, when a new act "concerning real property and to render titles to real property and to interests and estates therein, more safe, secure and marketable" (Laws 1927, pp. 598-608).

Florida. Act of November 10, 1828, sets a 20 years limitation on real actions (1839, pp. 154-157). Act of February 27, 1872 reduced the period to 7 years (1872. Ch. 1869, §3, 7). Also determines that continued occupation under a claim of title exclusive of any other right, but not founded upon a written instrument constitutes adverse possession (1882, Ch. 114, §7-8).

Kansas. An act to regulate the limitations of actions, passed at the first session of the legislative assembly, 1855, sets a 10 years limitation on action for the recovery of real property or the possession thereof (1855 Ch. 3 §1). Due to issues of legality and validity of the 1866 laws, the Legislative Assembly of 1859 elected a board of Commissioners "to prepare an entire code

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[33]The act of February 20, 1919 allows statute of limitation to run against married woman, but do no alter the period (Acts 1919, Act 100, pp. 90-91)

of laws, upon all subjects of general legislation pertaining to the interests of the Territory of Kansas, to be submitted from time to time to the Legislative Assembly, for their action upon the same" (See G.S. 1868, Preface). An act to establish a Code of Civil Procedure, passed by the 1859 session, repealed the existing law and set a 21 years limitation for actions for the recovery of the title, or possession pf lands (G.L 1859, Ch. 25, §16 pp. 83-83; C.L. 1862, Ch. 26 §16, pp. 126-127). At the session of 1867, an act was passed to appoint three Commissioners, "to revise and codify the civil and criminal codes of procedure, and all laws of a general nature, of this State". The new code was adopted with a few alterations at the regular session of 1868 (G.S. 1868, Preface, p. vi.). The new code sets a 15 years limitation in general for an action for the recovery of real property, and different period in some specific cases (G.S. 1868, Ch. 80, §16; 1897, Ch. 96, §10, pp. 83-84; 1901, Ch. 80, Art. 3, §4444, pp. 930-931; 1909, Ch. 95, §5608, pp. 1225-1226; 1923, §60-304, p. 803; 1935, §60-304, pp. 1209-1210).

Kentucky. The "Act to reduce into one, the several acts or parts of acts concerning Limitations of Actions", approved on December 17, 1796, and in force from January 1, 1797, sets a 20 years prescriptive period for adverse possession. Kentucky adopted the statute from Virginia at the time separation (Morehead & Mason Brown, A Digest of the Statute of Kentucky, 1834). Chapter 80 of the revised statutes of Kentucky, adopted by the General Assembly of the Commonwealth of Kentucky in November 1851, and taken into effect on July 1, 1852, sets a 15 years prescriptive period for adverse possession without record title, and 7 years for possession with title (Laws of Kentucky, 1851; Carroll 1914).

Michigan. An act for the limitation of suits, adopted May 15, 1820, limited all real and possessory actions to 20 years (Laws 1827, p. 255, §20). The act was amended to 10 years limitation on November 5, 1829 (Laws 1833,), and then later changed back to 20 years in 1838 (R.S. 1838, Ch. 1, §1, p. 573; R.S. 1846, Ch. 139, §1, p. 598; C.L. 1857, Ch., 164 §5350, p. 1403). The act of limitation was amended again in March 20, 1863, taken into effect January 1, 1864, under which an action for the recovery of land in cases where the defendant does not claims title under a deed was limited to 15 years (C.L 1871, Ch. 228, §1, pp.1973-1974; C.L. 1897, Ch. 267, §1, p. 2969; C.L. 1915, Ch. 234, §1, pp. 4358-4359; C.L. 1929, Ch. 266, §13964, p. 4964).

Minnesota. The Revised Statutes of the Territory of Minnesota, passed at the Second Session of the Legislative Assembly, 1851, limits action to recover real property within 20 years (R.S. 1851, Ch. 70, §4; G.S. 1867, Ch. 66, §3, pp. 450-451; G.S. 1878, Ch. 66 §4, p. 707). The law was amended to 15 years in April 24, 1889, in force from January 1 1891 (G.S. 1891, Ch. 66, §4688; R.L 1905, §4073, G.S. 1913, §7696; 1927 §9187).

Mississippi. An act for the limitation of actions, passed June 7, 1822 limits real and possessory actions and right of entry into lends within 20 years. It also vast full title after 50 years of actual possession (R.L. 1823, Ch. 21, §1-3).[34] The act was amended to bar actions and right of entry after 7 years, and to give full title after 10 years of adverse possession on February 24, 1844 (Hutchinson Code of Mississippi, 1848, Ch. 57, Art. 6, §1-3). It was amended again in March 1, 1854, taken into effect May 1, 1854, to limit actions and right of entry, as well as to give full title after 10 years (Laws 1854, Ch. 39, §3; R.S. 1857, Ch. 57, Art. 1; R.C. 1871, Ch. 45, §2147; R.C. 1880, Ch. 76, §2664; C. 1838, Ch. 83, §2730, 2734; C. 1906, Ch. 87, §3090; G.S. 1917, Ch. 45, §2454, 2458).

Missouri. An act prescribing the time of commencing actions, approved March 16, 1835, limits action to recover real property or the possession thereof within 20 years (R.S. 1835, p. 392; R.S. 1845, Ch. 109, §1). The act was amended to 10 years in February 2, 1847 (Laws 1847, p. 94; R.S. 1855, Ch. 103, Art. 1, §1; G.S. 1866, Ch. 191, §1; R.S. 1879, Ch. 48, Art. 1, §3219; R.S. 1889, Ch 103, Art. 1, §6764; R.S. 1899, Ch. 48, Art. 1, §4262; R.S. 1909, Ch. 21, Art. 8, §1879; R.S. 1919, Ch 12, Art. 8, §1305; R.S. 1929, Ch. 5, Art. 8, §850).

Montana. An act concerning limitation, approved February 9, 1865, sets 3 year prescriptive period for adverse possession of real property (Laws 1864, pp. 466-467, §3,4,6,7; Laws 1871, Ch. 41, §3,4,6,7). In 1877, the prescriptive period was extended to 5 years (L. 1877, Ap. p. §29, p. 45; 1st Div. Rev. Stat. 1879, §29, p. 45; 1st Div. Comp. Stat. 1887, §29, p. 65). "The legislative Assembly of the Territory of Montana, on the 14th day of may 1889, thereto impelled by the harassing incoherences and ambiguities of the Compiled Statutes of 1887, created a Code

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[34]Thus, the original claimer's right is barred after 20 years, and the adverse possessor's possession is secured after the same time, although he does not have full title.

Commission which [...] reported a Code of Civil Procedure, a Civil Code, a Penal Code and a Political Code, which were passed by the Legislative Assembly in 1895." (C.C.S. 1895, Preface, p. v). The newly adopted code of civil procedure further extended the prescriptive period to 10 years (C. Civ. Proc. 1895, §483, p. 783; Rev. C. 1907, §6432, p. 56; R.C.M. 1921, §9015, p. 76).

New Jersey. Under "An act for the limitation of suits respecting title to land", passed June 5, 1787, 60 years' actual, continued and uninterrupted possession of real estate vast full and complete right and title (Rev. 1847, Ch. 12, §1, p. 652; Rev. 1877, §23, p. 598). An act to amend the original act was passed on March 11, 1922. It set a 30 year limitation, except for woodlands or uncultivated tracts, for which the 60 years limitation remained (Laws 1922, Ch. 188, pp. 315-316).

North Carolina. First passed in 1715, and later amended, the North Carolina's Act of Limitations in the year 1837 bars claims for land after 7 years (R.S. 1837, Ch. 65, §1, pp. 371-372; R.C. 1855, Ch. 65, §1, p. 372). The act also determine that a 21 years of continued possession of any land under color of title, and with known boundaries give full title (R.S. 1837, Ch. 65, §2, p. 372; R.C. 1855, Ch. 65, §2, p. 372).[35] The Code of Civil Procedure of 1868 determine that no action may be sustained against a possessor of land under know and visible boundaries and colorable title for seven years, and that 20 years of adverse possession under know and visible boundaries (without color of title) gives title (C.C.P. 1868, §20, 23, pp. 12-13; C.C.P 1873, Ch. 17, §20,23, pp. 147-148; C.C.P. 1884, Ch. 2, §141,144 pp. 16-19; Code 1900, §141,144, pp.27-39; Rev 1905, Ch. 12, §382, 384, pp. 102-103; C.S. 1920, Ch. 12, §428, 430, pp. 426-431).

Orgon. Act of October 11, 1862, determine that actions for the recovery of real property, or the possession thereof, must be maintained with in 20 years (L. 1862, §1, p. 4; D 1863, §1, p. 4; C.G.L. 1887, §4, p. 132). Act of October 17, 1878 §1 amend the prescriptive period to 10 years (L. 1878, §1; H. 1892, §4, p. 132; B.&C. 1902, §4, p. 82; L.O.L. 1910, §4, pp. 134-135; O.L 1920, §4, p. 193; O.C. 1930, §1-202, p. 206).

Rhode Island. The Revised Statutes of the State of Rhode Island determines that 20 years of

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[35]Thus, the original claimer's right is barred after 7 years, while the adverse possessor's possession is not secured by the same time.

uninterrupted, quiet, peaceable and actual possession of land gives good and rightful title (P.L. 1844, §2, p. 220; R.S. 1857, Ch. 148, §2, pp.339-340; G.L. 1896, Ch. 205, §2, p. 672; G.L. 1909, Ch. 256, §2, p. 889). This period was reduced to 10 years in an amendment passed on April 18, 1912 (P.L. 1912, Ch. 798, pp. 122-123; G.L. 1923, Ch. 300, §2, p. 1280; G.L. 1938, Ch. 438, §2, p. 856).

South Carolina. An act passed by the general assembly of the Province of South Carolina on December 12, 1712, limits actions for the recovery of land rights to 5 years, and gives title to possessor after 7 years (1712, No. 323, §1, 2, p. 583-584). The act was amended in 1824 to bar action for the recovery of land titles after 10 years (Laws 1824, Ch. 5, §7, p. 24; 1837, Notes, p. 753). The code of procedure of the state of South Carolina, passed by the general assembly adjourned on March 1, 1870, sets a 20 years prescriptive period for adverse possession under a claim of title, exclusive of any other right and not founded upon a written document (C.P. 1870, §104, 107, 108, pp. 445-446; R.S. 1873, §101, 102, 104, 105, pp. 588-589). The general statutes and code of civil procedure, adopted by the general assembly of 1881-1882, amended the period to 10 years (C.P. 1882, §98, p. 33; Civ. P. 1902, §101, 104, 105, pp. 57-59; Civ. P. 1912, §126,129,130, pp. 47-49; Civ. C. 1922 §320,323,324, pp. 109-111; 1932 Code, §377,380,381, pp. 167-174).

Washington. Passed by the first legislative assembly of the Territory of Washington on 1854, the act of limitation of actions sets a 20 years limitation on actions for the recovery of real property of the possession thereof (Laws 1854, §2, p. 363; Laws 1859, §2, p. 290; Laws 1862, §17 p. 86; Laws 1869, §26, p. 8, Laws 1873, §26, p. 8; Laws 1877, §26, pp. 7-8;). The period is later reduced in 1881 to 10 years (Code 1881, Ch. 2, §26, p. 39). An act to quiet possessions and confirm titles to land, passed on February 16, 1893, determine that actions for the recovery of lands held by adverse possessor must be brought within 7 years, and that every person in actual, open and notorious possession of lands under claim and color of title, and paying taxes for 7 successive and continuous years, shall be held to be the legal owner (Laws 1893, Ch. 11, pp. 20-21; 1897, §5501, 5503, pp. 1529-1530; 1919, §7536, 7538, p. 2230, 1922, §786, 788, pp. 562-563).

West Virginia. An act limiting real actions and right of entry, passed February 5, 1831, limits real actions and right of entry to 15 years (Acts 1831, Ch. 30, §1, p. 98). An amended to the Virginia code, passed on March 27, 1861, set 15 years limitation to lands lying east of the Alleghany

mountains, and 10 years to land lying west of it (Laws 1861, p. 42). The 10 years limitations remained in power in the state of West Virginia (Code 1870, Ch. 104, §1, p. 546; Code 1887, Ch. 139, §2915, p. 698; Code 1891, Ch. 104, §1, p. 726; Code 1900, Ch. 104, §1, p. 775; Code 1914, Ch. 104, §4414, p. 1982; Code 1923, Ch. 104, §1, p. 1911).

Figure A.1: The Dynamic Effect of Changes to Land Rights Security
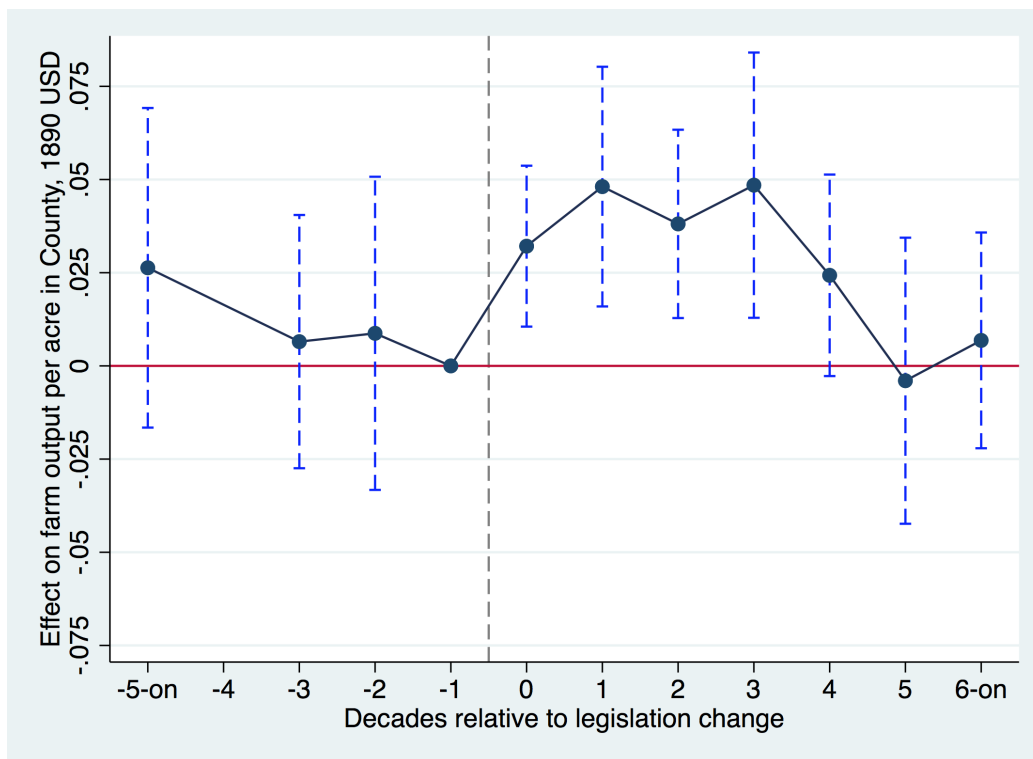
Note: This figure presents the dynamic effect of a one year decrease in the adverse possession prescriptive period, by plotting the regression coefficients and associated 90% confidence intervals for the treatment effect in a given year k relative to legislation change, i.e., the β_k from the dynamic difference-in-differences specification. The estimation treats increases and decreases of the prescriptive period symmetrically. Pre-trends are restricted to address under identification issue raised in Borusyak and Jaravel (2016). Standard errors are clustered at the state level. The horizontal axis is decades relative to a legislation change and the vertical axis is estimated effect on the real value of total agricultural production per acre.

Table A.2: Manufacturing and Urbanization

	Dependent variable:			
	Manufactured Output	% Manufacturing Workers	Manufacturing Capital	% Urban
	(1)	(2)	(3)	(4)
Adverse Possession	-0.3864	0.0097	-0.2619	-0.0976
Prescriptive Period	(0.4738)	(0.0375)	(0.3164)	(0.0755)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State-Specific Trend	Yes	Yes	Yes	Yes
Observations	15,482	16,251	10,699	19,847
R-squared	0.594	0.797	0.617	0.731
Dep. Var. Mean	31.087	2.675	15.072	11.019

Note: The dependent variable in column (1) is the real value of total Manufactured goods per acre in county, in column (2) it is the share of manufacturing workers out of total population in the county, in column (3) it is manufacturing capital per acre in the county, and in column (4) it is the share of urban population. Observations are at the county-decade level and the time units are decades. Standard errors in parentheses are clustered at the state level. [+] $p < 0.10$, [*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

Table A.3: Predictive Value of Productivity Changes

	Dependent variable: FD.Prescriptive Period			
	(1)	(2)	(3)	(4)
L.FD of Prescriptive Period	-0.0046	-0.0050	0.0091	0.0188
	(0.0254)	(0.0254)	(0.0264)	(0.0364)
L.FD of Farm output		-0.0272	0.2097	0.2010
		(0.0937)	(0.2516)	(0.2549)
L2.FD of Prescriptive Period			-0.0693	-0.0978
			(0.0530)	(0.0669)
L2.FD of Farm output			-0.4281	-0.4276
			(0.4078)	(0.4524)
L3.FD of Prescriptive Period				-0.0199
				(0.0195)
L3.FD of Farm output				-0.1270
				(0.1221)
Observations	318	318	270	222
R-squared	0.000	0.000	0.031	0.052
F-stat	0.033	0.084	0.748	1.206

Note: The dependent variable is the change (first difference) in adverse possession prescriptive period. Observations are at the state-decade level and the time units are decades. Standard errors in parentheses are clustered at the state level. F-stat is the F-statistic of the null hypothesis that that the coefficients on lags of FD of Farm output are jointly significant. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$