

## **Property Rights and Agricultural Production**

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This paper uses newly collected farm-level data from California and existing county-level data from the United States in 1860 to examine the effects of uncertain property rights on agricultural production. The farm-level data suggest that individuals with weaker property rights had fewer improved acres conditional on farm size. This appears to have been the primary mechanism through which weaker property rights led to lower farm and crop values, although even conditional on improved acres individuals with weaker property rights had lower farm values. We are able to rule out two alternative non-property rights hypotheses for these patterns, but do find some evidence that weaker property rights may have induced negative selection of farmers. The county-level data suggests that the problem of uncertain property rights was a frontier-wide, rather than a California-specific, phenomenon. These findings have implications for our understanding of the growth of American agricultural productivity over time and for the effects of changes in property rights in agricultural land in the Third World.

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## 1. Introduction

This paper uses a model and newly collected farm-level data on agricultural production in California in 1860 to generate the first historical estimates of the impact of uncertain property rights on agricultural output. At this time, property rights varied across farms and locations in California, and we exploit this variation to examine the effect of uncertain property rights on the share of improved acres, farm value, and the value of agricultural output. The farm-level data suggest that individuals with weaker property rights had fewer improved acres conditional on farm size. This appears to have been the primary mechanism through which weaker property rights led to lower farm and crop values, although even conditional on improved acres individuals with weaker property rights had lower farm values. We are able to rule out two alternative non-property rights hypotheses – individuals with weaker property rights arriving later or settling on more marginal land – for these patterns, but do find some evidence that weaker property rights may have induced negative selection of farmers. We also present cruder estimates of the effects of uncertain property rights on agricultural output using county-level data for the United States in 1860. While our main results are from California, the broader results for the United States and historical evidence both suggest that the California experience was not unique. Uncertain property rights appear to have been an issue on many parts of the frontier.

Our findings have implications for the understanding of American growth during the nineteenth century, much of which was built on agricultural production. The presumption has been that growth in agricultural productivity arose through a variety of channels including increased land under production, the spread of better farming

techniques, technological change in seeds and farm equipment, and specialization facilitated by development of the national transportation networks (Fishlow 1964, Hayami and Ruttan 1971, Ruttan 2005, Olmstead and Rhode 2002, 2003). This paper examines a widely underappreciated factor, which is the strengthening of property rights over time as uncertainty gave way to the issuance of federal land patents.

To the extent that the nature of the uncertainty in property rights that some farmers in California experienced is similar in nature and degree to the uncertainty faced by some farmers in the Third World today, it also has implications for our understanding of the contemporary uncertainty in property rights on agricultural production.<sup>1</sup> Indeed, our estimates of the negative effect of property rights on crop output are related to what other scholars have found for tenancy reform. We find that secure property rights would have more than tripled output on affected farms. This is larger than the effect of tenancy reforms, in part because it represents a much bigger change in the nature of property rights. Nearly all of this effect on output, however, comes from predicted increases in the number of improved acres, which can be thought of as acres under cultivation. Conditional on improved acreage, which is more comparable to the case of tenancy reform, we predict that output would have increased 18-32 percent. Banerjee, Gertler, and Ghatak (2002), Laffont and Matoussi (1995), and Shaban (1987) find increases in agricultural output of 62 percent, 33 percent, and 16 percent with tenancy reform.

## **2. Property Rights in Land in California**

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<sup>1</sup> Increasing the security of property rights has been a major theme of the World Bank (2003). In his widely read book *The Mystery of Capital*, Hernando de Soto (2000) discusses the state of property rights in the Third World. There is a related literature that examines the effects of property rights reforms in urban locations Jimenez (1984), Friedman, Jimenez and Mayo (1988), Lanjouw and Levy (2002), Field and Torero (2004), Field (2007). Alston et al (1996) examine land markets in rural Brazil.

In later sections of this paper, we examine the effect of uncertain property rights on agricultural production in California in 1860. In this section, we document the uncertainty of property rights. Property rights were generally uncertain in California in 1860, in the sense that very few patents for land had yet been issued.<sup>2</sup> Many individuals who held land, however, had a reasonable expectation that a patent would be issued for their land. Other individuals who held land, notably individuals hoping to preempt land from the federal government (a process we will describe shortly), faced considerable uncertainty regarding their property rights.

One note on terminology is in order. We will refer to individuals who are at least nominally attempting to preempt land interchangeably as squatters, settlers, or preemptors. They were variously described as such in California at the time, and historians have typically used these terms somewhat interchangeably as well.

### *Uncertain Property Rights*

In 1848, the United States formally acquired California from Mexico. This made the federal government the immediate owner of all land in California – the public domain. However, in the Treaty of Guadalupe-Hidalgo (1848), the United States pledged to protect property rights in the lands ceded by Mexico. To settle what was then a remote frontier, the Spanish and Mexican governments had made grants to citizens and naturalized citizens of one to eleven leagues (4,428 to 48,708 acres) of land.<sup>3</sup> When granting ended in 1846 as a result of American occupation, about 750 grants had been

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<sup>2</sup> Although patents now more typically refer to inventions, during the nineteenth century patents also referred to land. Federal land patents, which were issued for land in public lands states, represent federal government recognition of an individual's ownership of the land. In California, as in all public land states, all property rights derive from these original federal patents.

<sup>3</sup> Almost all owners received grants during the Mexican period under the Colonization Act of 1824 and the Supplemental Regulations of 1828.

made. These grants, which were primarily used as cattle ranches, covered more than twelve million acres of exceptionally fertile coastal and valley land.

To address the issue of Spanish and Mexican land grants so that the remaining land in the public domain could then be subdivided and sold, Congress passed the California Land Act in 1851. Under the act, an individual with a Spanish or Mexican land grant could submit documentary evidence of their claim to the land commission. The commission would then investigate the claim and issue a decision on the claim's validity. Either side – the federal government (as the residual claimant for all land) or the claimant – could then appeal the commission's decision to the U.S. District Courts in California and from there to the U.S. Supreme Court. Once validity had been established, a claim was surveyed, any boundary disputes were resolved, and the federal government issued a patent for the land. The entire process from the initial submission of a claim to receipt of a patent took, on average, 17 years.<sup>4</sup> By the beginning of 1860, approximately 730,000 acres had been patented. Although a large number of acres, it was small fraction of the 8.85 million acres that would ultimately be patented. Figure 1 shows the location of land patented to the owners of Spanish and Mexican land grants.

By 1860 the land commission and the courts had decided the validity of nearly all of the land claims brought under the California Land Act. For owners of Spanish and Mexican land grants whose claims had been confirmed, property rights were fairly secure. Indeed, they were sufficiently secure that some owners sold off part of the land to settlers, even though the land had not yet been patented. For example, Talbot Green, Thomas Larkin's property manager, wrote to Larkin in 1856 about sales on nearby

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<sup>4</sup> In a few instances, patenting would stretch into the 20<sup>th</sup> century. However, by 1880, 8.33 million out of a total of 8.85 million acres had been patented. Donaldson (1884), p. 381.

claims: “The squatters are now beginning to want to buy. Mr. Thoms sold 300 acres for twenty dollars per acre. Another squatter offers the same price for 100 acres, and another fifteen for 200 acres. I think as soon as the news comes out of the confirmation of Redding’s grant he will be able to sell all the land he wants to sell at that price, or at least the portion now occupied by squatters.”<sup>5</sup>

The status of other would-be land owners varied. Individuals who had purchased from the state of California also had relatively secure property rights. The state had been granted land for internal improvements, schools (16<sup>th</sup> and 36<sup>th</sup> sections of each township), a university, and swampland. Sales of the internal land grant and swampland were authorized by the state in 1852 and 1855, well before federal land sales – and in many instances federal surveying – had begun. State land purchasers were allowed to buy up to 320 and later 640 acres. Sales of state lands were highly irregular – county surveyors sold land without coordinating with the owners of land grants or federal land offices and often sold swamp land that was clearly not swampy – causing considerable conflict with federal officials.<sup>6</sup> Nevertheless, state courts generally upheld the validity of the property rights of purchasers of state lands. By 1860, approximately 450,000 acres had been sold by the state.<sup>7</sup>

Federal purchasers were also relatively secure, but they were few in number. By 1860 very little federal land had been surveyed and sold and most of that land was

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<sup>5</sup> Larkin X, p. 240. Talbot Green to Thomas Larkin, Feb. 9, 1856.

<sup>6</sup> In his 1856 report, the Surveyor General of California noted “The swamp land business in the State of California is yet entirely unsettled, although important correspondence has taken place on the subject between this office and the authorities of the State. In May last the register at Marysville reported that many county surveyors in the State had been returning to the authorities as swamp tracts of land not shown by the plats to be of that character.” Report of the Commissioner of the General Land Office Accompanying the Annual Report of the Secretary of the Interior (1856), p. 15. For more on the state’s highly irregular land policies and conflicts this created with the federal government, see Nash (1964), pp. 126-128.

<sup>7</sup> Nash (1964) p. 127.

located outside of the counties that we will examine. Federal land was sold on a cash basis in unlimited amounts. The average sale price was less than a penny over the government minimum of \$1.25/acre. Table 1 shows land sales by land office through the middle of 1860. Most of the surveying had begun in the interior, in the Central Valley (in the vicinity of the Marysville, Stockton, and Visalia land offices), because it was relatively flat – and thus easy to survey – and because it was well away from the land grants.<sup>8</sup> Through 1860 the number of acres sold was just under 149,000, and by the end of 1859 only about 20,000 acres of the land sold by the government had actually been patented. This is small in comparison to the number of acres in private land claims, both in total and relative to the acreage patented by the end of 1859.

It is useful to say something briefly about gold mining, since the gold rush had begun in 1848, and mining was still a dominant industry. Figure 2 shows that gold production was still high in 1860, although it was well below its peak. Mining had changed substantially from its early days. Large corporations now systematically extracted gold through quartz and hydraulic mining. These large corporations employed most of the 84,500 individuals who listed their occupation as miner in the 1860 Census of Population. In comparison, the 1860 Census of Population included 20,100 individuals who listed their occupation as farmer and another 12,500 who listed their occupation as farm laborer.<sup>9</sup> Despite its importance, mining was predominantly occurring in the Sierras and so was having a limited effect on property rights in most of the counties that we will examine.

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<sup>8</sup> The first government patents were issued in the interior as well. For location of the surveyed land, see the maps included in the Report of the Commissioner of the General Land Office Accompanying the Annual Report of the Secretary of the Interior (1856, 1860).

<sup>9</sup> Author's calculations based on the 1-100 national sample of the 1860 Census of Population.

## *Preemption*

An alternative to purchasing land from the owner of a land grant, the state, or what was available up to 1860 from the federal government was preemption. From the late eighteenth century on, Congress had, in a number of instances, conferred preemption rights on settlers – individuals who were squatting on the specific tracts of public land. Preemption rights allowed these settlers to buy the land they were on from the government at a fixed price rather than at auction. In the Preemption Act of 1841, Congress extended these rights to settlers on most surveyed land that was in the public domain.<sup>10</sup> Individuals could buy up to 160 acres at \$1.25 per acre. In 1853 Congress extended preemption rights to settlers in California and permitted preemption of unsurveyed land for the first year. Preemptors only had to file notice of such claims “within three months after the return of the plats of surveys to the land offices,” which in many locations meant that they would not have to file for several years. The Act specifically stated that preemption was not allowed on “lands claimed under any foreign grant or title.”<sup>11</sup>

Historical evidence indicates that the number of would-be preemptors was fairly large and that they often located on or near land grants. Since land grants encompassed some of the most desirable land, settlers often located on land grants in the hope that they would be rejected by the courts and thereby become part of the public domain. If this occurred, they could preempt the land. Theodore Hittell, a prominent nineteenth century historian, provided a general description of the incidence of squatting: “All around the bay of San Francisco and in most all portions of the country where Spanish or Mexican

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<sup>10</sup> On the politics behind the preemption act, see Kanazawa (1996).

<sup>11</sup> “An act to provide for the Survey of the Public Lands in California, the granting of Preemption Rights therein, and for other purposes. March 3, 1853” 10 Stat. 244, 246, c. 145



grants existed, there were squatters and squatter [preemption] claims.”<sup>12</sup> Some squatters in California declared their intent to exercise preemption rights even before 1853. For instance, in 1852 a ranch manager reported to the owner of a land grant: “A portion of the settlers are ... [taking] up what they call a preemption of 160 acres.”<sup>13</sup> And in 1860, the Surveyor General of California stated “A great body of the settlers are located adjoining to or upon land heretofore claimed by parties under grants.”<sup>14</sup> Orson Lyon, the defendant in an 1863 ejectment suit, argued, “That land is Public land belonging to the United State of America and at the time of the entry by this Defendant said land was vacant ... this Defendant made entry on said lands for the purpose preempting the same under the laws of the government.”<sup>15</sup> Lyon expressed the beliefs of many squatters, who felt that large land grants were un-American and that all of the land in California should have become part of the public domain and opened to preemption.<sup>16</sup>

Locating on or near land grants could be very problematic. The boundaries of land grants were in many instances not yet fixed. If one settled on a land grant, the settler could be forced to purchase land from the owner or be evicted. They were also vulnerable to losing their claims to nearby Spanish and Mexican land grants, since some surveyors unexpectedly included preemptions in the final surveys of the land grants. For example,

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<sup>12</sup> Hittell (1898), p. 678.

<sup>13</sup> Larkin IX, p. 83.

<sup>14</sup> Report of the Commissioner of the General Land Office Accompanying the Annual Report of the Secretary of the Interior (1860), p. 159. Further, we observe some owners ejecting squatters, which confirms squatters’ presence on land grants. See the General Index, Third Township Court of the State of California, Santa Clara County. Javier Alviso v. Orson Lyon, Third Township Court, Santa Clara County (1863). A. Ensworth to C. Coutts, July 3, 1861, Coutts Collection, Huntington Library. In the Supreme Court of the State of California. T. M. Slaughter, Plaintiff and Respondent, vs. Fowler & Gates, Defendants and Appellants, Huntington Library 384144. The Sonoma County Journal, August 27, 1858. Larkin X, p. 133, Samuel A. Morison to Thomas Larkin, Mar. 6, 1855. In one instance, the attorney estimated that the squatter had spent \$350 fighting ejection. A. Ensworth to C. Coutts, July 3, 1861, Coutts Collection, Huntington Library. General Index, Third Township Court of the State of California, Santa Clara County.

<sup>15</sup> Javier Alviso v. Orson Lyon, Third District Court, Santa Clara County (1863).

<sup>16</sup> Pisani (1994) reviews much of the squatter debate.

in response to the apparent inclusion of their land, the settlers near Tzabaco Rancho in Sonoma County “mobbed the surveyors, [and] destroyed their field notes.”<sup>17</sup> The problem was sufficiently common that in 1860, Congress required public advertisement of the completion of land claim surveys and permitted settlers to appeal to the district court if their lands were improperly included.<sup>18</sup>

Most individuals seem to have planned to preempt the full 160 acres. Although individuals were permitted under the preemption acts to preempt less than 160 acres, it is not clear that they had an incentive to do so. Preemptors appear not to have paid taxes, so the only cost of holding 160 acres, as opposed to a smaller amount, would be any ongoing costs of defense. Most of these costs were fixed. Paying the costs gave the preemptor the option to – but not the requirement to – purchase the land at \$1.25 per acre at some later date. Given that land values were rising fast and in some counties were well in excess of \$10 per acre in 1860, it seems likely that the cumulative cost of defending an acre over several years was less than the \$8.75 or more per acre that the individual would ultimately reap. Squatters leagues, like claims clubs elsewhere, probably lowered the cost in some locations by promising mutual defense against owners and others.<sup>19</sup>

By 1860 because of the unsettled boundaries of land grants and the confusion caused by the sale of state lands, very few individuals would have had an opportunity to formally preempt and pay for their land. Indeed, the Surveyor General of California, in

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<sup>17</sup> Gates (1991), p. 175.

<sup>18</sup> Gates (1991), p. 179.

<sup>19</sup> On Midwestern claims clubs, see Bogue (1958). Squatters’ leagues were reported in a number of locations. The leagues served two purposes: i) defining and registering property rights and ii) organizing violent and non-violent activities to protect their property rights. For examples of squatters’ leagues, see Jack (1912), Eldredge (1912), Gates (1991).

his 1860 discussion of settlers quoted above, was using their presence to argue for additional funds so that their land could be surveyed.

Thus, compared to owners of confirmed or patented private land claims, owners of federal land, and owners of state land, preemptors had much more uncertain property rights. Their rights were contingent on the federal government eventually becoming the owner of the land. In particular, their rights were subordinate to the rights of owners of Spanish and Mexican land grants. In practice, their rights were also subordinate to the rights of individuals who had purchased state land. In 1856, the Surveyor General of California reported settlers “found their ‘lands, improvements and dwelling houses covered up by these swamp and overflowed land claims.’”<sup>20</sup> The fact that state legislation favorable to squatters’ property rights was passed in 1849/50, 1856, and 1858 is also indicative of their numbers, their influence, and the risks that they believed they faced. The squatters were not, however, successful in using legislation to bolster their position – the first statute was overruled by federal legislation and the latter two were struck down by the courts.<sup>21</sup>

Not surprisingly, uncertain property rights had negative effects on preemptors’ willingness to invest in their property. In 1860, the Surveyor General of California commented explicitly on this issue:

Owing to the insecurity of titles, the settler has placed mere temporary fences and improvements on his farm, nor can he become permanently settled, until his lines of demarcation are fixed. The settler only wishes to know where, with safety to his limited capital, he can build his house, raise his crops or vine, graze his stock, and hew his lumber. To him these are matters of great moment, and, as I before stated, the policy of the

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<sup>20</sup> Report of the Commissioner of the General Land Office Accompanying the Annual Report of the Secretary of the Interior (1856), p. 15.

<sup>21</sup> Gates (1991).

government should be to foster the settler, by giving him permanency and stability, and thus increase the wealth of the nation.<sup>22</sup>

### 3. Labor Supply When Property Rights are Uncertain

One of the central equations in labor economics is that  $MRS = MPL$ , where  $MRS$  is the marginal value of time and  $MPL$  is the marginal product of labor. Now allow  $p$  to index the security of property rights in the product of one's labor, where  $p = 1$  is complete security of property rights and  $p = 0$  is complete insecurity of property rights. If  $p$  simply acts to shift the marginal product function – which is to say it acts as a probabilistic tax – this implies that  $MRS = pMPL$ .<sup>23</sup> Under reasonable assumptions about  $MRS$  and  $MPL$ , the foregoing equation has the immediate implication that individuals with less secure property rights will provide less labor and consume more leisure.

Further suppose that an individual can engage in a range of activities over which  $p$  varies. If activities are not mutually exclusive and individuals have heterogeneous vectors of  $p$ , then individuals will choose to engage in different mixes of activities. Relative to an individual with completely secure property rights in all activities, individuals with less secure property rights will provide less labor and consume more leisure. Further, conditional on labor provided, the mix of activities undertaken with less secure property rights will be skewed towards activities in which they have relatively more secure property rights.

This discussion highlights two propositions that we will test empirically:

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<sup>22</sup> Report of the Commissioner of the General Land Office Accompanying the Annual Report of the Secretary of the Interior (1860), p. 159.

<sup>23</sup> This model is similar to the model in Besley (1995). The other two parts of his model are less relevant here, because preemptors could not borrow against their land and gains from trade appear not to have been a focus.

- Individuals with less secure property rights, because they provide less labor, will have lower shares of improved acres (i.e. land cleared for agricultural production), lower agricultural output, or both.
- Individuals with less secure property rights will chose activities with relatively more secure property rights. In our context this might include raising livestock, which can be marched off the property, and growing crops with shorter rather than longer growing seasons. Activities with less secure property rights would include improving acreage and building non-transportable objects such as houses, barns, and fences.

One extension of this model would allow for individuals to invest labor both in production ( $L_1$ ) and in activities designed to enforce property rights ( $L_2$ ) so that  $p$  would be a function of  $L_2$ .<sup>24</sup> Under reasonable assumptions regarding  $p(L_2)$ , this extension will not alter the comparative statics outlined above.

#### **4. The Effect of Uncertainty**

##### *Data*

The data we use to test the foregoing predictions are farm-level data for 1,024 farms located in California in 1860. We collected 100 percent samples of farms in eight townships from the manuscript records of the 1860 Census of Agriculture.<sup>25</sup> The census data for each farm includes information on the number of improved and unimproved acres, the value of farm implements, the value of livestock, the level of output of a long list of crops, and the value of the farm. The eight townships were located in eight

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<sup>24</sup> For models with this focus, see Skaperdas (1992), Grossman and Kim (1995), and Hirshleifer (1995).

<sup>25</sup> Only farms that had at least 3 acres were included in the sample, since smaller farms were essentially large gardens. Farms with less than 3 acres were 109 of the 1133 farms. Unpublished data for five of the townships were provided to the author by Jeremy Atack. The remaining three townships were collected by the author.

counties, and the location of these counties is shown in Figure 3. Two of the counties – Shasta and Fresno – were considerably larger than they are today, and the approximate locations of the historic boundaries are marked. Four of the eight townships – the townships in Alameda, Contra Costa, Santa Clara, and San Mateo counties – were located in counties with significant numbers of land grants. We will refer to these counties as land-grant counties, and to the four counties with few or no land grants – Fresno, Placer, Shasta, and Sutter – as non-land-grant counties.

To understand the representativeness of the sample, it is useful to compare our sample both to the counties they were located in and to the state as a whole. With respect to the eight counties, the sample includes 32 percent of the farms, 25 percent of the total acreage, 32 percent of the improved acreage, 27 percent of the farm value, and 39 percent of the crop value.<sup>26</sup> With respect to the state, our sample includes 7.3 percent of the farms, 3.3 percent of the total acreage, 5.6 percent of the improved acreage, 7.5 percent of the farm value and 11.0 percent of the crop value. On a per acre basis, the farms in the sample had roughly twice the farm value per acre, value of crop output per acre, and value of crop output per improved acre as the average farm in the state.

Table 2 provides detailed summary statistics on the eight townships and the eight counties that they were located in. The percentage of preemptors varied from 46 percent in Contra Costa County to 16 percent in Fresno County. County land values varied from \$18 per acre in Alameda and Santa Clara Counties to \$5 per acre in Shasta County. The

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<sup>26</sup> Crop value is calculated by multiplying the prices by the quantities produced and adding them up. The measure includes the value of orchard and market garden produce (both were reported by respondents in dollar values), but does not include livestock slaughter value, butter or cheese production, or home manufacturers. Prices for wheat, barley, and oats are from 1859 Transactions of the State Agricultural Society of California (p. 325 (wheat \$1.00/bu.), 327 (barley \$0.83/bu.), and 329 (oats \$0.75/bu)). Values for wheat and barley in Berry (1984) are similar to the prices listed in Transactions. All other prices are national average prices from the county-level data on the Agricultural Census available from ICPSR Study No. 2896.

share of land that would ultimately be patented to the holders of Spanish and Mexican land grants varied from 55 percent in San Mateo County to 0 percent in Fresno County. The share of land that had been patented by the end of 1859 to the owners of land grants similarly varied from 23.1 percent in San Mateo County to 0 percent in Fresno County.

### *Security of Property Rights*

Empirically, we are interested in testing the theoretical predictions regarding the effects of uncertain property rights by using preemption as a proxy for uncertain property rights. In this subsection, we show that the empirical evidence is consistent with the theoretical predictions – individuals with uncertain property rights had fewer improved acres, lower farm values, and lower crop outputs. In the next subsection, we consider alternative explanations for the patterns we observe including: selection, late arrival, and settlement on poorer quality land.

Ideally the 1860 Census of Agriculture would have explicitly identified the property rights status of farms in the sample.<sup>27</sup> It does not, so we are forced to infer whether farms were preempted or not based on whether the farm included 160 acres – the maximum number of acres that could be preempted and the number of acres that the vast majority of preemptors seem to have chosen to preempt. Of the 1,024 farms, 34 percent were 160 acres.<sup>28</sup> This is consistent with historical evidence indicating that there were substantial numbers of squatters who at least nominally were planning to preempt the land they were on.

To the extent that we are imperfectly identifying preemptors, it will bias our results downward. That is, some of farmers with 160-acre farms may not have been

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<sup>27</sup> Unfortunately, historical evidence of preemption filings appears not to have survived. And land patents do not indicate whether the land was preempted.

<sup>28</sup> This is in line with what Atack and Bateman (1987) find for farms in Minnesota and Kansas.

preemptors, and some people with 80 or 120 acres may have been preemptors. The number of non-preemptors with 160 acres may not, however, be all that large. Recall that purchasers of state land could purchase up to 320 and later 640 acres. Although federal land could also be sold in any amount, no federal land had been patented in our eight counties by the end of 1859, and land sales were well away from these locations. So it is unlikely that any of the individuals in our sample had purchased federal land. Further individuals purchasing from the owner of a land grant could purchase any amount. Thus, the number of people purchasing from state government or owners of land grants who chose exactly 160 acres is likely to have been relatively small. As we discussed previously, the number of preemptors with 80 or 120 acres is also unlikely to have been large. To the extent that some people with 160 acres actually did have secure property rights or some people with, say, 80 or 120 acres were actually preemptors, this will bias down the measured effect of uncertainty. It will also make it more unlikely that we will find a negative and significant effect.

Our results may also be biased downward by a second factor – the negative externality that preemption may have had on other farmers. If preemptors were likely to capture other farmer’s cattle or establish themselves on cropland already under cultivation, then the optimal response of other farmers may have been to reduce their holdings of livestock or to limit the extent of their crops. This will diminish the measured effect of uncertainty.

We include township and township-acres fixed effects in all of the regression specifications. Thus, the identification for the effect of preemption is coming from comparisons of preemptors (individuals who held 160 acres) to individuals with other



farm sizes within a township. In all regressions, we also control for total acres, so intuitively what we are looking for is whether farmers with 160 acres have fewer improved acres, lower implement values, lower farm values, and lower crop values than we would expect given the outcomes for individuals with other farm sizes.<sup>29</sup>

We will separately examine the effects of preemption in land grant and non-land-grant counties to adjust for the differences in environments. For example, preemptors in non-land-grant counties were at very low risk for being surveyed into a Spanish or Mexican land grant. Thus, their property rights may have been relatively more certain. They may, however, still have faced considerable uncertainty. For example their land was still at risk for being deemed swampland and sold through the state. Further, they may have faced the risk of gold being found on their land, particularly in Placer County.<sup>30</sup> Thus, it is not a priori obvious whether the relative effect will be negative (because they faced less uncertainty) or positive (because they faced greater uncertainty).

Table 3 shows that the effect of preemption on the share of improved acres, the value of farm implements, farm value, and crop value for the full sample of 1,024 farms was large, negative, and statistically significant. Specifically, column 1 shows that controlling for township and township-acres fixed effects, preemptors in land grant and non-land-grant counties had significantly fewer improved acres than one would expect given their farm sizes. Columns 2-4 show that controlling for township and township-acres fixed effects, preemption had large negative effects on implement values, farm values, and crop values. For example, a preemptor in Alameda County – the land-grant

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<sup>29</sup> This approach is similar to a regression discontinuity approach, although, as we will see when we discuss selection, not all of underlying assumptions of these models are met.

<sup>30</sup> Of the 845 miners who were in California in the 1-100 national sample of the 1860 Census of Population, 3 were in Fresno County, 65 were in Placer County, 11 were in Shasta County, and 0 were in Sutter County.

county with the largest number of farms in the sample – had only 57 percent of the predicted share of improved acres, 29 percent of the predicted value of implements, 56 percent of the predicted farm value, and 24 percent of the predicted crop value. A preemptor in Shasta County – the non land-grant county with the largest number of farms in the sample – had only 56 percent of the predicted share of improved acres, 51 percent of the predicted value of implements, 55 percent of the predicted farm value, and 30 percent of the predicted crop value. Given that 20 percent of the acreage in our sample was preempted and that crop value was roughly 30 percent of the predicted value on preempted farms, the aggregate effect of eliminating preemption (or making property rights secure for preemptors) would have been to increase crop value by 16 percent for the sample as a whole.<sup>31</sup>

Columns 5-7 show that most of the negative effect of preemption was attributable to preemptors' lower share of improved acres. Once we control for the share of improved acres, the negative effect of preemption on implement values and crop values is not statistically significant. We will return to the insignificant effect of preemption on crop values in the next subsection when we examine alternative hypotheses. Notably, the effect of preemption on farm value is negative and statistically significant, although much smaller. Preemptors' farms were less valuable, even controlling for improved and unimproved acreage. This difference in farm value may derive both from lower investment in buildings and fences and from insecure property rights.

Table 4 tests the theoretical prediction (and the historical contention) that uncertain property rights would affect the mix of output. In this context, we believe uncertain property rights were causing farmers to choose livestock or short season crops

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<sup>31</sup> 16 percent =  $1/(0.8*1+0.2*0.3)$

such as wheat as opposed to crops that had longer seasons or required multi-year investments such as fruits and nuts. In addition to being a subject of discussion in the Surveyor General's report in 1860, the effect of uncertainty of title on farmers' willingness to invest in their land was widely discussed at the time.<sup>32</sup> As California historian Rodman Paul noted, "The fact that grain offered a quick return, with payment at the end of the very season in which the wheat was planted, and that it demanded a minimal initial investment were attractive features in a land where rates of interest on capital were high and where title to much of the best and most accessible land was shrouded in uncertainty."<sup>33</sup>

Columns 1 and 2 show that conditional on their total acreage, preemptors were producing similar amounts of wheat and had similar values of livestock to other farmers in their townships. The results are comparable when we control for improved and unimproved acres, with the exception of wheat in non-land grant counties. Preemptors in townships non-land grant counties did produce more wheat than other farmers in those townships. The amounts were both large – 62 percent – and statistically significant.

In sum, what we find empirically is consistent with the theoretical predictions regarding the effect of uncertain property rights. Controlling for farm size, preemptors in both land grant and non-land grant counties had fewer improved acres, lower implement values, lower farm values, and lower crop values than other farmers, all of which are consistent with them having less secure property rights. The evidence is more mixed on the extent to which preemptors shifted to livestock or short season crops.

### *Alternative Explanations*

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<sup>32</sup> See Alta California 1851, Jan 11, Paul (1973) p. 22 quoting Hittell (1863) , and Transactions of the State Agricultural Society (1866), p. 74 .

<sup>33</sup> Paul (1973), p. 20.

Although the results we presented are consistent both with theoretical predictions involving uncertain property rights and with historical evidence on squatting, in this section, we explore whether alternative explanations such as selection, late arrival, and poorer quality land could account for the patterns we observe.

Thus far we have implicitly assumed that all individuals had the same marginal product of labor, although they may have differed (exogenously) in the security of their property rights. In fact, however, individuals with less secure property rights may also have had lower marginal product of labor (or a higher value of leisure). Further, they may have chosen to squat, and thereby have had less secure property rights, precisely because they had lower marginal product of labor than other farmers.

To explore this issue, we matched the farm owners listed in the 1860 Census of Agriculture to the manuscript records for the 1860 Census of Population. We were able to uniquely link 869 farm owners to their records in the Census of Population. The main impediment to linking in some locations was that some farms were jointly owned. In some instances, it was possible to link the farm to multiple individuals. In other cases, the only the last names or even abbreviations for the last names were listed, making it impossible to link the farms to the owners. We only use cases where the farm could be uniquely linked to one person. In unreported regressions, we repeated the analysis in Tables 3 and 4 on this subgroup. The results are very similar, which suggests that the ability to link individuals and farms is largely random.

Table 5 compares adult white males ages 18-69 in the public use 1-100 sample of the 1860 Census of Population with individuals in the linked sample. Compared to the average adult male in California, men in our sample were older, wealthier and less likely

to be foreign born. When we restrict attention in both samples to individuals who list their occupations as farmers, the two samples look much more similar, although farmers in the public use sample were still poorer. This is not surprising, since all of the townships we sample are in the northern part of the state, where property values were higher, and four of the eight townships are in the San Francisco Bay area.

We investigate the characteristics of preemptors in Table 6 to see whether they were younger, poorer, or less likely to list their occupation as farmer (perhaps due to lower experience). Column 1 shows that, controlling for acreage and any differences across townships, preemptors were the same age as other farm owners. Column 2 shows that preemptors reported significantly lower values of real property than other farm owners. This regression includes both township and township-acres fixed effects, so preemptors' real property was somehow less valuable. This is not surprising given our finding on farm value in Table 3. However, real property and farm value are not identical, because individuals may own other real property, and they may not own their farm.<sup>34</sup> Columns 3 and 4 shows that, compared to other farm owners, preemptors reported similar levels of personal property and were as likely to report their occupation as farmer.<sup>35</sup> In sum, the main dimension on which preemptors differed from other farm owners was in the value of their real property.

The fact that preemptors held less real property than other farm owners is consistent with, although not necessarily evidence for, negative selection. To further explore selection, Table 7 repeats the analysis in Table 3, but now controls for the

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<sup>34</sup> In addition to not asking about preemption, the 1860 Census of Agriculture did not ask about tenancy status. Thus, the farmer listed in the census may be an owner or a renter. Historical evidence indicates that renting was relatively uncommon.

<sup>35</sup> The results are robust to controlling for age in columns 2-4 and to using a polynomial of total acres instead of the  $\ln(\text{total acres})$ .

personal characteristics of the farmer. In columns 1-4, we control for the farmer's age and whether he lists farmer as his primary occupation in the Census of Population. In columns 5-7, we also control for the farmer's real and personal property. These results should be interpreted cautiously, because of the correlation between real property and farm value.

Although farmers' characteristics have considerably explanatory power for all four outcomes, controlling for their characteristics has a limited effect on estimated outcomes. Relative to column 1 of Table 3, in column 1 of Table 7 controlling for individual characteristics slightly decreases the effect of preemptors in both locations on the share of improved acres, but the effect remains both statistically significant and large. In columns 2-4 of Table 7 the coefficients on the effect of preemption in both locations on the value of implements, farm value and crop value are of similar sign, significance, and magnitude to the coefficients in columns 5-7 of Table 3. In columns 5-8 of Table 7, where we also control for real and personal property, the fit improves slightly. The results are qualitatively similar to the results in columns 1-4, although the effect of being a preemptor in a land grant county is no longer statistically significant.

One concern is that preemptors were unobservably different than individuals who owned farms with fewer or more acres, something that conditioning on observables may not correct for.<sup>36</sup> In particular, preemptors may have had an unobservable taste for leisure or violence. If this is true, then the coefficients on preemption are capturing two effects – the effect of  $p$  and the fact that lower  $p$  induced individuals with lower  $MPL$  (or higher  $MPS$ ) to settle on the land. If this is true, merely strengthening preemptors' property

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<sup>36</sup> Besley (1995) discusses this issue in the context of Ghana. He is able to overcome this problem by using variation in the rights to fields held by individual farmers. Unfortunately, the data preclude us taking a similar approach.

rights would not equalize production in the short run. In the long run, however, if preemptors with secure property rights then sold their land to individuals with higher *MPL* – who would be willing to pay more for it than someone with a lower *MPL* – then production on farms that were preempted and farms that were not should equalize.<sup>37</sup> Thus, the fact that the coefficient on preemption is capturing both uncertain property rights and negative selection caused by uncertain property rights is really just a problem of interpretation.

We mentioned two other possible explanations for negative effects of preemption that had nothing to do with property rights. One explanation was that individuals with 160 acres preemptors merely arrived later on average than their counterparts with larger or smaller farms. Late arrival can account for preemptors lower share of improved acres and lower output. Farmers may have had less time to clear their land, causing them to have fewer improved acres. Further, to the extent that late arrivers were simultaneously engaged in clearing land and growing crops, it could have depressed their productivity per improved acre. It is less obvious that late arrival can explain why preemptors in some townships produced more wheat than other farmers in those townships.

The historical evidence, some of which we presented above, suggests many squatters were already on the land in the early 1850s. To add just one more example, on February 11, 1854, the Alta California noted that there were 300 people on the San Antonio Rancho in Oakland, California who had purchased land from the Peralta family

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<sup>37</sup> Unlike the regression discontinuity approach and other methods of causal inference, we are not interested in – or unable to estimate – the effect of uncertain property rights on specific individuals. Instead, we are interested in the long run effect, assuming that the characteristics of the individuals will equilibrate through land sales once property rights are secure across all farm sizes.

and another 1500 on the land without title.<sup>38</sup> Thus, the squatters were hardly late arrivers. For the subset of farmers with children, one can infer the length of time they had been in California based on the birthplace of their children. The time for preemptors and non preemptors was similar at approximately four years. While the evidence does not definitely rule out the possibility of late arrival, it certainly suggests that most squatters had probably been on their land for a number of years.

The second explanation was poorer quality land. Poorer quality land might affect the payoff to improving acreage, leading to fewer improved acres, and depress the yield per improved acre. Historical evidence suggests this is not the case – if anything squatters were choosing the most valuable land. For example, the squatters on Henry Dalton’s land in Southern California chose the main water source for the ranch. This led to a protracted battle.<sup>39</sup> In 1856 when he was discussing the case of the preemptors losing their land to swamp claims, the Surveyor General of California mentioned “that in some instances the lands thus claimed were valued at \$50 per acre.”<sup>40</sup> In 1860, the average land values in Santa Clara and Alameda counties – two of the counties with the highest land values in the state – were \$18 per acre, so the land in question was quite valuable. This pattern of location on valuable land is what we would expect, given the squatters’ nearly limitless choice set.

Importantly, in column 8 of Table 3, where we control for the number of improved acres, and in columns 4 and 8 of Table 7, where we control for the number of improved acres and the characteristics of the farmers, preemptors in both land grant and

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<sup>38</sup> Alta California, February 11, 1854.

<sup>39</sup> See Jackson (1987).

<sup>40</sup> Report of the Commissioner of the General Land Office Accompanying the Annual Report of the Secretary of the Interior (1856), p. 15.



non-land-grant counties did not have statistically significantly different crop values than other farmers. This suggests that their land quality was either similar to or, if they were working it less intensively, possibly even better than other farmers in their township. Further, analysis of the distribution of preemptors by townships does not show clumping of 160-acre farms, as would be the case if there were large areas of relatively poorer land.<sup>41</sup> Of course, this does not rule out the possibility that bad land was sprinkled randomly throughout the township, but taken together with the historical evidence, the negative affects do not appear to be attributable to poorer quality land. Finally, poorer quality land cannot explain why, controlling for the number of acres, preemptors in some townships produced more wheat than other farmers.

In sum, of the three alternative explanations that we examined, the evidence was not consistent with preemptors arriving later or locating on lower quality land. We did find some evidence that was consistent with negative selection on observables, although the effect on the estimated coefficients was fairly modest. Negative selection may have been occurring on unobservables as well. As we discussed, to the extent that the coefficient on preemption is capturing both uncertain property rights and negative selection caused by uncertain property rights, this means that the short run effects of strengthening property rights will be smaller than the long run effects.

## **5. Some Evidence on the Effects of Preemption in the United States**

A central question is whether California's experience with respect to uncertain property rights and agricultural production was part of a more general phenomenon or

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<sup>41</sup> Unfortunately, the census does not provide detailed locational information. If it did, we could test this hypothesis directly.

was somehow unique to California. To investigate this question, we use county-level data on crop value per acre, the share of improved acres, farm value per acre, and the distribution of farm sizes from the 1860 Census of Agriculture for all existing counties in the United States. The data include 1,977 counties in 40 states.

The analysis of the effect of preemption in this context is much cruder than it was using farm-level data. One of the main reasons is that the distribution of farm sizes is quite coarse at higher levels. All farms of 100-499 acres are grouped together in a single category, as are farms of 500-999 acres, and farms of 1000+ acres. From the size distribution, one can construct a very crude proxy for the number of farms that are 160 acres. We will denote the share of farms that are 100-499 acres as a share of all farms in a county as  $d$ . This is at best a very imprecise measure of what we really want, which is the share of farms that are 160 acres as a share of all farms.<sup>42</sup> The imprecision is likely to bias downward any estimated effect. A second reason for the crudeness of the analysis is the possible endogeneity of the share of improved acres and farm value per acre. Thus, all results should be taken as suggestive. Clearly more detailed farm-level work remains to be done.

In Table 8, we ask what the effect of  $d$  is on the value of county crop output per acre, controlling for the share of improved acres in the county, the share of farms that were more than 500 acres, and state and state-share of improved acres fixed effects. In column 1, we estimate the average effect across all states. The coefficient on  $d$  is negative and statistically significant. That is, on average across all states, counties within a state that had more 100-499 acre farms had lower output per acre. This could, however,

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<sup>42</sup> The two measures will likely be positively correlated, if for no other reason than the fact that farms of 160 acres are a subset of farms that are 100-499 acres.

reflect variation in county land values. So in column 2, we control for county farm values per acre. The coefficient on  $d$  falls by about one-third, but remains negative and statistically significant.

If  $d$  is in fact capturing uncertainty in property rights and not some unspecified scale effects or other variables, we would expect it to vary across regions. Because property rights in eastern states were relatively secure in 1860, we aggregate them into a single region, East Coast. This region encompasses the New England, Middle Atlantic, South Atlantic, and East South Central census regions. In column 3, we repeat the specification in column 1, but allow  $d$  to vary across regions.<sup>43</sup> The coefficient on East Coast is negative and statistically significant. Although not statistically significantly different from the coefficient on East Coast, the coefficients on the East North Central and West North Central are negative, indicating that increases in  $d$  had greater negative effects in these regions. The coefficient on West South Central is positive but not significant, and the coefficient on Pacific (California) is negative and statistically significant. Thus, with the exception of the West South Central, all of the other ‘frontier’ census regions had more negative values of  $d$  than the East Coast aggregate region. In column 4, we repeat the specification in column 2, which controlled for farm value per acre, but allow  $d$  to vary across regions. As before, with the exception of the West South Central, all of the other ‘frontier’ census regions had more negative values of  $d$  than the East Coast aggregate region. However, now that we have controlled for farm value per acre, the coefficients on East North Central, West North Central, and Pacific are all statistically significantly different from East Coast.

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<sup>43</sup> The results are similar if we allow the share of farms greater than or equal to 500 acres to vary across regions. In unreported regressions, we also controlled for the value of livestock per acre and the number of slaves per acre. Neither variable was statistically significant.

Assuming the East Coast effect of  $d$  does not reflect property rights and that other region deviations from the East Coast  $d$  do reflect property rights, the aggregate effect of  $d$  on crop value per acre in the East North Central, the West North Central, and the Pacific census regions implied by column 4 is -11 percent. Most of the effect is being driven by the East North Central and West North Central census regions because they have many more counties than California (the Pacific census region) and many more acres in farms. This effect is of the same order of magnitude of the aggregate effect we computed for California, -16 percent, using farm-level data. About 30 percent of national acreage in farms was in the East North Central, the West North Central, and the Pacific census regions, so a crude estimate of the aggregate effect on national output is -3.2 percent.

Overall, the county-level data is consistent with preemption being a significant source of uncertainty in other parts of the frontier and not just in California.

## **6. Conclusion**

This paper used a model and farm-level and county-level data to examine the effect of uncertain property rights on agricultural output. In California, we found that individuals with uncertain property rights had lower agricultural output. The historical and empirical evidence suggests that the effect was caused by uncertain property rights and not by later settlement or settlement on more marginal land. We find some evidence of negative selection of individuals into preemption, although the effects are not all that large. This suggests that strengthening property rights will typically not raise output to

the level of other farms in the short run. In the long run, as the farms are sold to more productive individuals, we would expect output to rise further.

Why is this important? The large effects that we find using farm-level data for California and county-level data for the United States imply that the strengthening of property rights may well played an important role in the expansion of agricultural output in the United States during the nineteenth century. For example, agricultural output per worker is estimated to have risen at the rate of 0.70 per year over the period 1800-1900 (Weiss 1993). Much of the increase came after 1840, when preemption became more prevalent. For example, the rate for 1850-1900 was 1.15 percent per year. It was this increase in productivity that allowed shifts in the workforce towards other economic activities such as manufacturing. Yet, property rights and the role they played in this increase have received virtually no attention.

Because the United States historical experience is often used to understand development of economies more broadly, the lack of attention to the strengthening of property rights is not entirely benign. Property rights are now a major focus for the World Bank, but this focus on property rights is quite recent. Our findings support the literature on tenancy reform, which show that property rights reforms can have sizeable positive effects on agricultural output.

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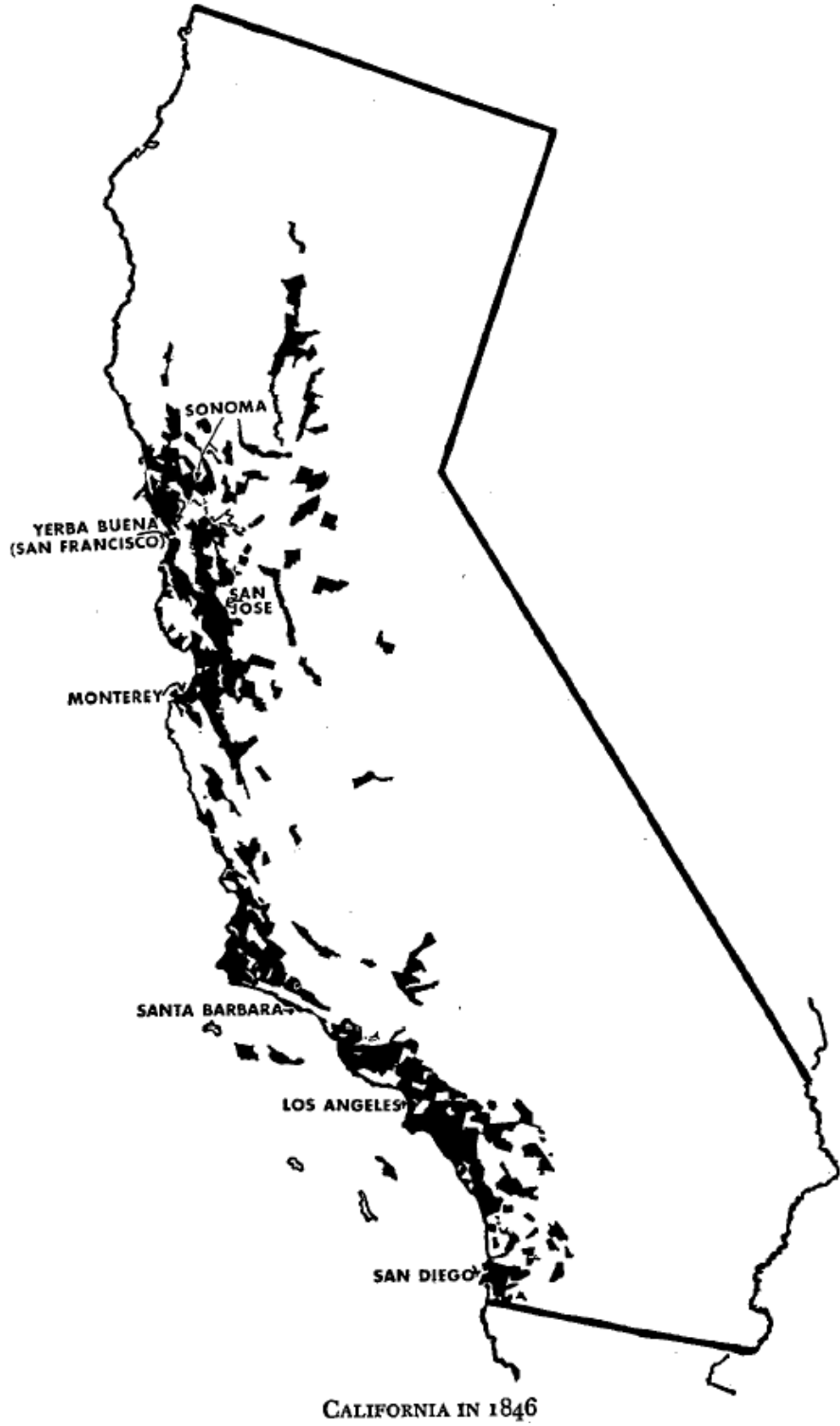
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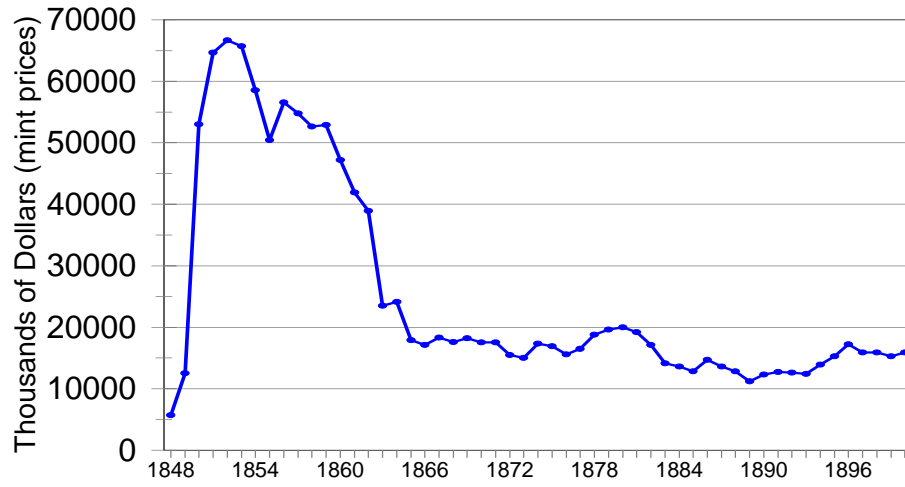


Figure 1: Map Showing Location of Land Grants



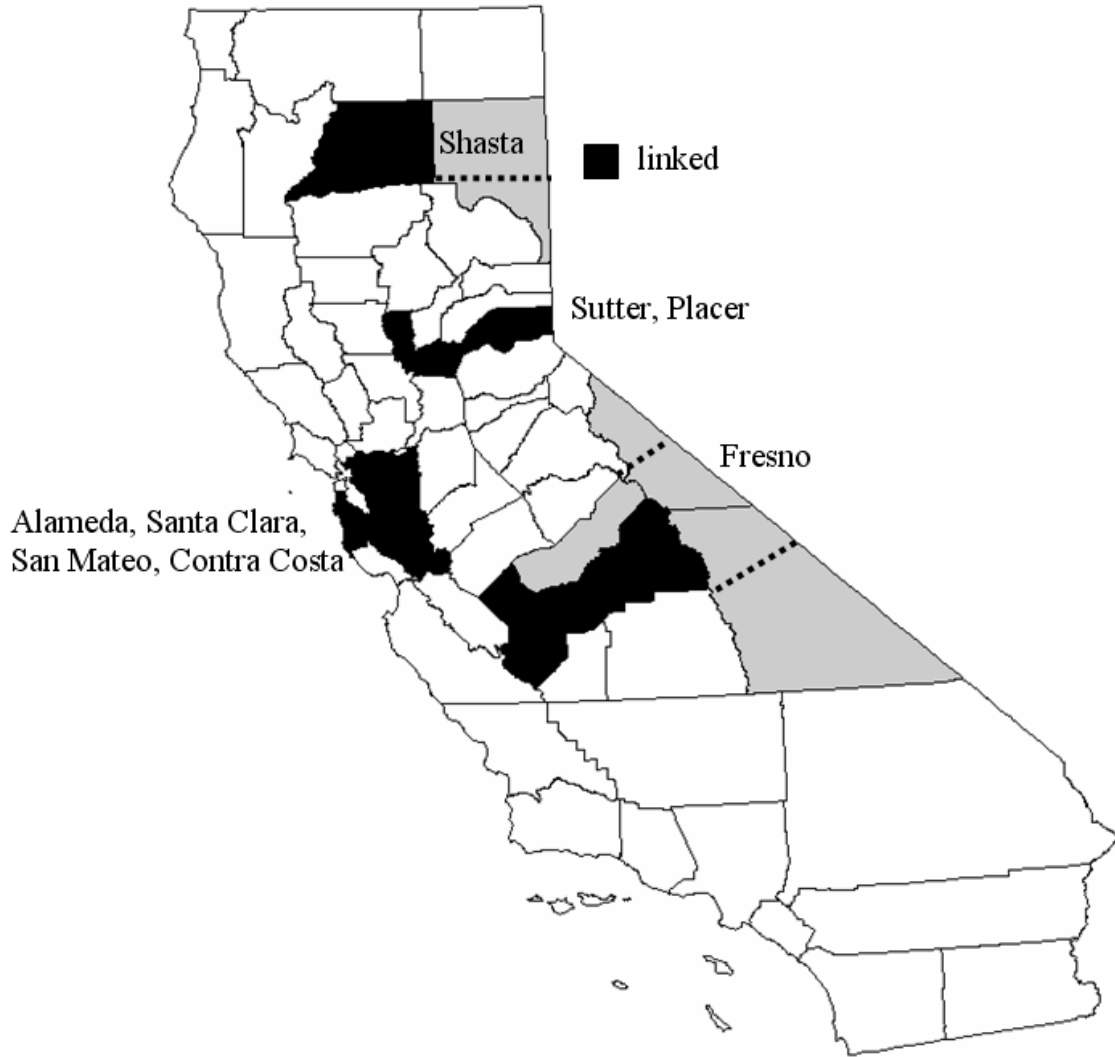
From Robinson (1948), p. 68.

Figure 2: Gold Production in California over Time



Source: Berry (1984), pp. 74, 76, 78.

Figure 3: Map of Counties in Sample



Notes: Counties containing linked townships are in black. Shasta and Fresno counties were larger in 1860 than they are today. Counties that were part of these counties in 1860 in whole or part are in gray and the approximate historical boundaries are shown with dotted black lines.

Table 1: Federal Land Sales 1857-1860

	7/1/57- 12/31/57	1/1/58- 6/30/58	7/1/58- 12/31/58	1/1/59- 6/30/59	7/1/59- 12/31/59	1/1/60- 6/30/60	Total
	Acres						
San Francisco	675.07	539.08		1,208.69	1,400.00	926.80	4,749.64
Los Angeles					39.71		39.71
Marysville		4,915.85	5,056.83	22,963.14	4,755.96	4,908.08	42,599.86
Humboldt			5,791.49	26,545.34	3,212.83	4,650.43	40,200.09
Stockton			2,774.02	22,981.32	2,982.38	1,899.18	30,636.90
Visalia			1,393.88	16,870.99	5,511.37	6,987.70	30,763.94
<b>Total</b>	<b>675.07</b>	<b>5,454.93</b>	<b>15,016.22</b>	<b>90,569.48</b>	<b>17,902.25</b>	<b>19,372.19</b>	<b>148,990.14</b>

Notes: Report of the Commissioner of the General Land Office Accompanying the Annual Report of the Secretary of the Interior, For the Year 1860, pp 50, 56. 1859, pp. 202, 208. 1858, pp. 144, 150. Based on the proceeds of sale in the various reports, all of the above acreage sold at \$1.25 per acre. No land sales were listed before July 1, 1857 in reports of the General Land Office.

Table 2: Summary Statistics for Townships

County	Acres in Farms in Township	Farms in Township	Preemptor percent	County Land Value	Acres in Farms County	Farms in County	Land grant share	LG pat. end 1859
	<i>Township, 1860</i>			<i>County, 1860</i>				
Alameda	56,773	228	32	18	240,915	658	0.40	0.072
Contra Costa	56,354	193	46	9	205,836	447	0.42	0.038
Fresno	12,584	57	16	8	23,201	85	0.00	0.000
Placer	24,419	59	24	6	90,289	254	0.002	0.002
San Mateo	47,381	80	21	11	169,940	304	0.55	0.231
Santa Clara	23,802	106	28	18	166,548	665	0.48	0.087
Shasta	48,009	229	41	5	78,043	218	0.005	0.005
Sutter	19,073	72	43	15	168,005	549	0.08	0.005
<i>Total</i>	<i>288,395</i>	<i>1,024</i>	<i>35</i>		<i>1,142,777</i>	<i>3,180</i>		

Notes: The townships are: Alameda (Eden), Fresno (Township #1), San Mateo (Township #2), Shasta (whole county), Sutter (Nicolaus), Santa Clara (Fremont), Placer (Township #10), Contra Costa (Township #2). The data in the first three columns are from the sample. The data in next three columns are county statistics of the 1860 Census of Agriculture, available at ICPSR. The last two columns are authors calculations based on Bureau of Land Management (BLM) land patent records, which comprise the original patents for all public land in the United States. The BLM data are available online from the BLM or from rootsweb.com. Numbers for Shasta and Fresno are approximate. In 1860, Shasta County included most of what is today Lassen County, so records for the two modern counties were included. In 1860, Fresno County included Madera County and parts of Mono and Inyo Counties. The calculations shown are only for the modern Fresno and Madera Counties. No public land in any of the counties other than land encompassed by land grants had been patented by the end of 1859.

Table 3: The Effect of Preemption – Baseline

	1	2	3	4	5	6	7
	Share Improved Acres	Ln value of implements	Ln farm value	Ln crop value	Ln value of implements	Ln farm value	Ln crop value
Preemptor – land grant	-0.324** (0.114)	-1.219 (0.781)	-0.588 (0.412)	-1.418* (0.740)	-0.225 (0.149)	-0.124** (0.0463)	-0.213 (0.300)
Preemptor – non land grant	-0.310*** (0.0122)	-0.656** (0.276)	-0.589*** (0.110)	-1.205** (0.363)	-0.0891 (0.210)	-0.274** (0.108)	-0.247 (0.255)
Ln total acres	-0.0923*** (0.00105)	0.679*** (0.0237)	0.496*** (0.00943)	0.754*** (0.0312)			
Ln improved acres					0.800*** (0.00988)	0.493*** (0.0115)	0.993*** (0.0225)
Ln unimproved acres					0.0775** (0.0302)	0.130* (0.0636)	0.0345 (0.0435)
Township & Township-acres fixed effects	Y	Y	Y	Y	Y	Y	Y
Observations	1024	1024	1024	1024	1024	1024	1024
R-squared	0.315	0.215	0.297	0.239	0.411	0.411	0.434

Notes: Standard errors are in parentheses, are robust, and are clustered by township. \*, \*\*, and \*\*\* denote statistical significance at the 10, 5, and 1 percent levels.

Table 4: Preemption, Wheat, and Stock

	1	2	3	4
	Ln Wheat (bushels)	Ln Stock Value	Ln Wheat (bushels)	Ln Stock Value
Preemptor – land grant	-1.519 (0.845)	0.0439 (0.162)	0.155 (0.204)	-0.0654 (0.196)
Preemptor – non land grant	-0.512 (0.335)	0.210 (0.148)	0.624*** (0.151)	0.296 (0.169)
Ln total acres	0.774*** (0.0289)	0.440*** (0.0127)		
Ln improved acres			0.826*** (0.0177)	0.264*** (0.00828)
Ln unimproved acres			-0.0462 (0.0510)	0.136*** (0.0376)
Township & Township-acres fixed effects	Yes	Yes	Yes	Yes
Observations	1024	1024	1024	1024
R-squared	0.275	0.150	0.468	0.109

Notes: Standard errors are in parentheses, are robust, and are clustered by township. \*, \*\*, and \*\*\* denote statistical significance at the 10, 5, and 1 percent levels.

Table 5: Characteristics of Men in California in 1860

Occupation	Age	Real Property	Personal Property	Farm Value
All-IPUMS	32	340	466	
Linked - MS	37	3872	2747	3553
Farmer-IPUMS	35	1725	2107	
Farmer-MS	37	3848	2907	3885
	Farmer	Foreign Born	Preemptor	Number obs.
All-IPUMS	0.09	0.51		2120
Linked - MS	0.83	0.30	0.34	868
Farmer-IPUMS	1	0.26		198
Farmer-MS	1	0.28	0.33	738

Notes: All data are for white men ages 18-69. The first two lines are drawn from the IPUMs 1-100 sample. The remaining lines are drawn from the linked sample. Farmer is the share listing their occupation as farmer. Preemptors are individuals with 160-acre farms. Debtors are individuals who have real property values that are less than their farm values.



Table 6: Characteristics of Preemptors in 1860

	1	2	3	4
	Age	Ln Real Prop	Ln Pers Prop	Farmer
Preemptor	0.255 (0.610)	-0.693** (0.266)	0.0755 (0.145)	-0.0699 (0.0849)
Ln Total Acres	1.007*** (0.239)	0.627*** (0.0222)	0.464*** (0.0121)	0.0667 (0.0443)
Township fixed effects	Yes	Yes	Yes	Yes
Township-acres fixed effects	No	Yes	Yes	No
R-Squared	0.027	0.305	0.122	0.122
Number observations	869	869	869	869

Notes: Standard errors are in parentheses, are robust, and are clustered by township. \*, \*\*, and \*\*\* denote statistical significance at the 10, 5, and 1 percent levels.

Table 7: The Effect of Preemption Controlling for the Characteristics of the Farmer

	1	2	3	4	5	6	7	8
	Ln share improved acres	Ln value of implements	Ln farm value	Ln crop value	Ln share improved acres	Ln value of implements	Ln farm value	Ln crop value
Preemptor – lg	-0.262*** (0.0547)	-0.233 (0.195)	-0.171*** (0.0350)	-0.319 (0.317)	0.261*** (0.0546)	-0.185 (0.189)	-0.103 (0.0702)	-0.236 (0.315)
Preemptor – non lg	-0.279*** (0.0271)	-0.00740 (0.317)	-0.216* (0.108)	-0.211 (0.327)	-0.278*** (0.0272)	0.0186 (0.331)	-0.189* (0.0974)	-0.176 (0.325)
Age	0.000732 (0.00131)	0.0134* (0.00585)	0.00462 (0.00302)	0.0138 (0.00772)	0.000667 (0.00117)	0.00773 (0.00611)	-0.000264 (0.00288)	0.00746 (0.00730)
Farmer	0.265* (0.116)	0.867*** (0.223)	0.0731 (0.121)	0.487** (0.194)	0.264* (0.122)	0.766*** (0.214)	0.0149 (0.113)	0.405* (0.186)
Ln total acres	-0.137*** (0.0180)				-0.137*** (0.0161)			
Ln imp. acres		0.707*** (0.0394)	0.531*** (0.0239)	1.016*** (0.0302)		0.658*** (0.0482)	0.485*** (0.0189)	0.956*** (0.0316)
Ln unimp. acres		0.0466 (0.0298)	0.128 (0.0767)	0.0183 (0.0393)		0.0205 (0.0223)	0.108 (0.0709)	-0.00881 (0.0411)
Ln real property					0.00117 (0.00403)	0.0746** (0.0268)	0.0855* (0.0394)	0.108** (0.0431)
Ln pers. property					0.000214 (0.00632)	0.0597 (0.0459)	0.00829 (0.0251)	0.0194 (0.0198)
Township & Township-acres fe	Y	Y	Y	Y	Y	Y	Y	Y
Observations	869	869	869	869	869	869	869	869
R-squared	0.331	0.381	0.423	0.435	0.331	0.397	0.452	0.449

Notes: Standard errors are in parentheses, are robust, and are clustered by township. \*, \*\*, and \*\*\* denote statistical significance at the 10, 5, and 1 percent levels.

Table 8: The Effect of Preemption Across Census Regions

	1	2	3	4
<i>Dependent variable</i>	<i>Ln crop value/acre</i>			
d (Share farms 100-499 acres)	-0.776*** (0.206)	-0.528*** (0.139)		
d-East Coast			-0.801*** (0.200)	-0.458*** (0.158)
d-East North Central			-0.364 (0.233)	-0.474*** (0.170)
d-West North Central			-0.0158 (0.385)	-0.692** (0.258)
d-West South Central			1.341 (0.930)	0.808 (0.538)
d-Pacific			-1.551*** (0.267)	-0.909*** (0.295)
Share farms > 500 acres	2.169*** (0.380)	1.383*** (0.276)	2.114*** (0.382)	1.300*** (0.261)
Ln (acres)	-0.0435 (0.0259)	-0.0389*** (0.0121)	-0.0496** (0.0239)	-0.0421*** (0.0117)
Ln(share improved)	1.486*** (0.0101)	1.192*** (0.0312)	1.433*** (0.0379)	1.163*** (0.0296)
Ln (farm value/acre)		0.440*** (0.0450)		0.432*** (0.0477)
State and state*lnacimpsh	Y	Y	Y	Y
Constant	3.756*** (0.270)	2.553*** (0.120)	3.497*** (0.278)	2.401*** (0.108)
Observations	1944	1944	1944	1944
R-squared	0.792	0.838	0.800	0.842

Notes: d is the share of farms that are 100-499 acres. The omitted category is farms that are 3-100 acres. East Coast includes the New England, Middle Atlantic, South Atlantic, and East South Central census regions. Standard errors are robust and are clustered by state. \*, \*\*, and \*\*\* denote statistical significance at the 10, 5, and 1 percent levels.