

# Checkerboards and Coase: The Effect of Property Institutions on Efficiency in Housing Markets

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## Abstract

In the late 1800s, Palm Springs, California, was evenly divided into 1-mile-square blocks—like a checkerboard—and property rights were assigned in alternating blocks to the Agua Caliente tribe and a non-Indian landowner by the U.S. federal government. The quasi-experimental nature of land assignment holds land quality constant across the two types of landowners. Sales, mortgaging, and leasing restrictions on the Agua Caliente Reservation land created large transaction costs to development on those lands; consequently, there was very little housing investment. The non-Indian blocks, which were extensively developed, provide a benchmark for efficient outcomes for the Agua Caliente lands. Once the restrictions on Agua Caliente lands were relaxed in 1959, the number of homes and real estate values converged to those of non-Indian-owned lands as predicted by the Coase theorem.

## 1. Introduction

The area that is now known as Palm Springs, California, was originally inhabited by the Agua Caliente Band of Cahuilla Indians. In 1876, President Ulysses S. Grant established via executive order the Agua Caliente Reservation, which would eventually total 31,610 acres (Tiller 1996).<sup>1</sup> The Coachella Valley was divided into evenly sized 1-mile-square blocks that collectively resemble a giant check-

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<sup>1</sup> For additional history of the Agua Caliente tribe, see Agua Caliente Band of Cahuilla Indians, History and Culture (<http://www.aguacaliente.org/HistoryCulture/tabid/57/Default.aspx>).

erboard. The U.S. federal government gave the odd-numbered blocks to the Southern Pacific Railroad, while the even-numbered blocks were assigned to the Agua Caliente tribe (Kray 2004). Later, in the General Allotment Act of 1887 (25 U.S.C.A. 331), the U.S. Congress established individual American Indian ownership of land, or allotments, on many American Indian reservations—including the Agua Caliente Reservation (Wilkins 2002).<sup>2</sup> Previously, all reservation lands had been held communally by the various tribal governments.

The quasi-experimental nature of this land assignment holds land quality constant across the Indian- and non-Indian-owned land in the Palm Springs region. Property institutions, however, differ significantly between these two land holdings. The land given to the Southern Pacific Railroad, and eventually sold to non-Indian landowners, was held in fee-simple status, which allowed it to be sold, traded, leased, or mortgaged (Kray 2004). The land assigned to the individual Agua Caliente tribal members, in contrast, was held in trust by the U.S. federal government. Trust lands cannot be easily sold, traded, leased, or used as collateral for mortgages.<sup>3</sup>

This research focuses directly on the effect that this property institution, trust status, has on investment. Previous research found large inefficiencies associated with trust status relative to fee-simple status in agricultural investment on a subset of American Indian reservations (Anderson and Lueck 1992). I show that, under certain conditions, this property institution—trust lands—provides outcomes very similar to those for fee-simple status. Prior to the existence of these conditions, however, I document significant underinvestment in housing development on the Agua Caliente lands relative to similar, non-Indian-owned fee-simple lands. Given the sales, leasing, and mortgaging restrictions on trust lands prior to 1959, the value of homes located on Agua Caliente lands was only 19 percent of the value of homes located on fee-simple lands in Palm Springs. The Agua Caliente landowners, largely cash poor, were unable to self-finance housing development on their lands, and their only other asset, the trust land itself, could not be used as collateral for bank financing (Kray 2004, p. 95).

Significant changes to trust land leasing and sales restrictions in the 1950s had an observable impact on investment in the following years. The Indian Long-Term Leasing Act of 1955 (25 U.S.C. 415 [August 9, 1955]) increased the allowable lease length for certain American Indian tribes, including the Agua Caliente, from 5 to 25 years. In addition, the Agua Caliente Equalization Act of 1959 (25 U.S.C. 951 [September 21, 1959]) established the final assignment of lands to Agua Caliente tribal members and greatly facilitated the conversion of

<sup>2</sup> I use the term American Indian, as opposed to the term Native American, as the trust land status and reservations are unique to the indigenous people of the 48 contiguous U.S. states. Native Hawaiians and Alaskans do not, strictly speaking, have reservations or the same type of trust lands as American Indian tribes. See Wilkins (2002) for a description of the differences.

<sup>3</sup> See Shoemaker (2003), Anderson (1995), and the Indian Land Tenure Foundation, Glossary (<http://www.indianlandtenure.org/ILTFallotment/glossary/terms.htm>), for a discussion of the legal differences between American Indian trust lands and fee-simple lands.

trust lands to fee-simple lands (Tiller 1996). Agua Caliente landowners began to either lease their remaining trust lands or sell their newly converted fee-simple lands to housing developers in the 1960s and 1970s in record numbers. I show, after 1959, a convergence in both the number and value of homes on American Indian lands in Palm Springs over the next 40 years. Non-Indian fee-simple lands were unaffected by these two changes in trust land regulations, and therefore the fee-simple land serves as a useful benchmark. The results are a clear illustration of the Coase theorem in a real-world situation—when property rights are clearly defined and transaction costs are removed, agents are able to bargain their way to efficient outcomes regardless of the original assignment of property rights (see Coase 1960, 1992).<sup>4</sup>

The next section details the historical and institutional setting for American Indian trust lands. I discuss the obstacles that trust lands pose to investment incentives. Section 3 provides evidence for the convergence of the stock of housing on Agua Caliente lands with fee-simple lands in Palm Springs over the 1950–2000 period using U.S. census data. Section 4 examines the convergence in housing values between the Agua Caliente lands and fee-simple lands over the same period. First, I examine the difference in average housing values by tenure status. Second, I run a hedonic regression to control for different housing characteristics by tenure status. Section 5 concludes.

## 2. Trust Land Status and Its Impact on Investment Incentives

### 2.1. *Historical and Institutional Setting*

The history of American Indian land is long and complex. I present only a brief introduction to American Indian lands, reservations, and trust land status.<sup>5</sup> By the late 1800s most American Indian tribes had been permanently settled onto reservation lands. These settlements were the result of treaty negotiations, forced relocation, and containment efforts. In an attempt to improve the conditions of American Indians, the U.S. federal government, through the General Allotment Act, converted these communally held American Indian lands to individual privately held lands. The U.S. Congress passed the Dawes Act with the intent of stimulating small-scale farming by individual American Indian families. At the time, many American Indians lived in nonsedentary agricultural and non-market-based economies, and abrupt conversion was not successful. The land privatization program had neither an accompanying educational com-

<sup>4</sup> Medema and Zerbe (2000) provide an excellent review of nonlaboratory tests of the Coase theorem.

<sup>5</sup> See, for instance, Wilkins (2002) for a general overview of American Indian land tenure and the politics involved in the changing of tenure status over time. Anderson (1995) provides an excellent description of the conditions and incentives of land tenure on American Indian reservations from an economics perspective. Royster (1995) provides an excellent description of the experience of land privatization and conversion to fee-simple status from a legal perspective. Shipek (1988) describes in detail the California Indian experience. Carlson (1981, 1983) also provides a good history of the privatization of American Indian lands and the loss of these lands.

ponent nor training. Consequently, American Indians lost their lands because of nonpayment of property taxes or sold their lands unknowingly for less than market value. In 1887, prior to privatization, American Indians controlled approximately 138 million acres; by 1934 that amount had fallen to 48 million acres, a loss of almost two-thirds of the 1887 total (Canby 1998). The reduction in the land base was not accompanied by any improvement in living conditions for American Indians. In fact, conditions worsened (Meriam et al. 1928).

The Meriam report provides an evaluation of the U.S. federal government's forced privatization program: "It almost seems as if the government assumed that some magic in individual ownership of property would in itself prove an educational civilizing factor, but unfortunately this policy has for the most part operated in the opposite direction" (Meriam et al. 1928, p. 7).

In response to the large loss of land and the further erosion of conditions for American Indians, the U.S. Congress authorized the Indian Reorganization Act of 1934 (25 U.S.C. 477), which placed the remaining tribally held and individually held American Indian lands into trust status. The express purpose of this property institution is to protect against loss of the land—it cannot be seized by banks, states, or local governments. Trust lands held by American Indians are also not subject to property taxes. Finally, the process for trust land sales is lengthy and requires the approval of U.S. Department of Interior officials. Therefore, trust land status provides significant protection for land, but it also adds to the complications for land investment.

## *2.2. Obstacles to Development on Trust Land*

I briefly discuss in this section the ways in which trust land status poses an obstacle to investment. Access to credit markets is severely restricted when trust lands are the sole collateral source. Commercial lending institutions cannot seize trust land in the case of mortgage defaults, and this precludes a standard means of financing that is available to fee-simple landowners. Lack of access to credit markets meant that the few homes that were built on the Agua Caliente land in the first half of the twentieth century were self-financed and of poor construction.

Sales restrictions are the second obstacle to development on trust lands. If the owner of an asset cannot afford to invest or develop it, then a sale or transfer of the asset to someone with the means to do so will improve the economic well-being of all parties. However, the lengthy bureaucratic approvals necessary for conversion of trust land to fee-simple land and the incomplete assignment of trust land property rights prior to 1959 served as an insurmountable obstacle to development on Agua Caliente lands.

The third obstacle to development on American Indian trust land is leasing restrictions. Leasing of American Indian lands to land developers was difficult given the relatively short lease lengths imposed by the U.S. Department of the Interior Bureau of Indian Affairs. Maximum lease lengths for American Indian

lands were set at 5 years in the 1930s. These short lease lengths discouraged developers from pursuing long-term investments such as housing on American Indian lands. In the mid-1950s, lease lengths were extended to 25 years, and in September 1959, the Agua Caliente Equalization Act set maximum leases for the Agua Caliente tribe at 99 years.

Two changes occurred in the 1950s that significantly changed the incentives to invest on Agua Caliente trust lands. First, the Indian Long-Term Leasing Act of 1955 increased the allowable lease lengths for Agua Caliente trust lands to 25 years. Second, the Agua Caliente Equalization Act of 1959 provided a final, equal assignment of Agua Caliente trust lands to individual Agua Caliente tribal members. These two changes significantly reduced the obstacles to leasing and sales of Agua Caliente lands.

### 3. Convergence in the Palm Springs Housing Stock

Table 1 presents the changes in housing stock for Palm Springs for 1950–2000 using data from the U.S. Census of Population and Housing. The time series data provide the stock of homes located on trust and nontrust lands at each housing census (U.S. Census Bureau 1960–2000b).<sup>6</sup> I also compute a rate of growth for the housing stock by tenure status for each decade.

There were a little over 3,400 homes in all of Palm Springs in the 1950 census, but the census does not contain information on the ownership status of Palm Spring lands. By 1960, there were over 7,400 housing units in Palm Springs—with less than one-third of these homes located on trust land. The growth rate of the housing stock during the 1960s is actually lower for trust lands than for fee-simple lands, and the difference may be due, in part, to a lengthy court battle between the county of Riverside, California, and the Agua Caliente tribe. The tribe asserted that improvements on leased lands were nontaxable, while the county of Riverside held that the non-Indians residing on trust lands were responsible for property taxes on any improvements or investments; the corresponding tax uncertainty appears to have discouraged some development. The case was settled in favor of the county of Riverside in the U.S. Supreme Court in 1972.<sup>7</sup> Following the resolution of the court case, there was a large spike in housing development on trust lands in Palm Springs. Housing growth more than tripled on trust lands by the 1980 census, while it did not even double on

<sup>6</sup> See Appendix A for a full discussion of the housing stock data from the U.S. censuses.

<sup>7</sup> The case was initially decided by the U.S. appellate court in 1971 in favor of the county of Riverside (*Agua Caliente Band of Mission Indians v. County of Riverside*, 442 F.2d 1184 [U.S. App. 1971]). On appeal, the Supreme Court upheld the lower court's decision in 1972 (*U.S. Agua Caliente Band of Mission Indians v. County of Riverside*, 405 U.S. 933, 92 S. Ct. 930, 30 L. Ed. 2d 809 [1972]).

Table 1  
Housing Growth in Palm Springs, 1950–2000

Census Year and Land Tenure	Housing Units	Total Decade Growth Rate of Housing Units
1950 Trust and fee-simple lands	3,409	
1960 Trust land	2,382	
1960 Fee-simple land	5,104	
1970 Trust land	3,506	.47
1970 Fee-simple land	8,450	.66
1980 Trust land	11,452	2.27
1980 Fee-simple land	15,952	.89
1990 Trust land	20,840	.82
1990 Fee-simple land	21,129	.32
2000 Trust land	20,926	.00
2000 Fee-simple land	21,239	.01

Source. U.S. Census Bureau (1950–2000b).

Note. The ratio of housing on trust lands in 2000 to housing on trust lands in 1960 is 8.78. The ratio of housing on fee-simple lands in 2000 to housing on fee-simple lands in 1960 is 4.16. The ratio of trust lands(2000/1960) to fee-simple lands(2000/1960) is 2.11.

fee-simple lands. Overall, housing growth on trust lands was 111 percent higher than on fee-simple lands from 1960 to 2000.<sup>8</sup>

#### 4. Convergence in Real Estate Values

After trust land restrictions have been relaxed, there should be a convergence of trust land and fee-simple real estate values.<sup>9</sup> Table 2 presents the difference in real estate values by tenure status for Palm Springs in 1960 and 2004.<sup>10</sup> In 2004 dollars, the ratio of trust to fee-simple land values was 5.26 in 1960. While

<sup>8</sup> There are 42,165 housing units in Palm Springs in the 2000 U.S. census, but in the cross-sectional data that I use, there are only 30,012 housing units. This difference is due to the fact that the census counts each dwelling as an individual unit, including apartments and duplex homes. In the cross-sectional data, I have restricted my sample to individually owned single-family residences or condominiums.

<sup>9</sup> I take real estate value to mean the value of land and all improvements (housing structure) located on the parcel.

<sup>10</sup> It should be mentioned that the census data provide standard real estate values—they include both the land and housing structure value for trust and fee-simple lands in 1960. For 2004, I use data from the county of Riverside tax assessor's office. The tax assessor's data contain both sales and assessed values. The tax assessor is required by law to use the sales values as the basis for all assessments. A detailed discussion of the tax assessor's valuation methods is presented in Appendix B. A simple regression of log assessed value on log sales values shows that there is a statistically significant slope coefficient of .98. Therefore, the assessed values follow the sales values very closely on average. Also, in the case of trust lands, there are explicit sales values for the housing structure but not for trust lands. The tax assessor uses the lease length, lease payments, and current interest rates to compute a present value for trust lands. The present value of the land is added to the sales value of the structure to create the real estate assessed value (California State Board of Equalization 2002). This estimation, based on market negotiated rates for the leases, is the best available data on the market value of both the land and physical structure. I use the assessed value of real estate, as it is the best measure of investment across both fee-simple and trust lands.

Table 2  
Average Housing Prices by Land Tenure Status

	1960	2004
Trust land	35,095	161,220
Fee-simple land	184,600	184,876
Ratio of fee-simple to trust land	5.26	1.15

Sources. U.S. Census Bureau (1960), Bureau of Economic Analysis, National Income and Product Accounts, and 2004 Riverside County Tax Assessor Data.

Note. Land values are in year 2004 dollars.

the investment on fee-simple lands was more than five times the amount on trust lands, by 2004 the ratio had fallen dramatically to 1.15.<sup>11</sup> A more qualitative measure of the difference in real estate value by land tenure status is also contained in the 1960 U.S. census—approximately 48 percent of the trust land homes were characterized as “deteriorating” or worse, while the corresponding average for all homes in Palm Springs was only 5.8 percent. The homes located on the Agua Caliente lands contrasted greatly with the neighboring luxury hotels and homes of the Hollywood elite in Palm Springs in these early days. Local newspapers at the time described homes located on trust lands as a “mess,” a “slum,” and a “nuisance” (Kray 2004, pp. 96, 118–20).

#### 4.1. Accounting for the Remaining Differences in Real Estate Values

Tables 3 and 4 further explore the causes of the residual difference between trust and fee-simple real estate in 2004. I use the county of Riverside tax assessor’s data for the following analysis, as these data provide a richer set of control variables than are available in the census data: they contain all of the characteristics of the actual dwelling as well as the lot size, construction and latest sale dates, assessed value of the property, and location variables. I coded dwellings according to whether they are located on the trust or fee-simple blocks in Palm Springs using tax assessor maps, reservation maps, and 2004 county of Riverside tax assessor data. A detailed discussion of the creation of this data set is given in Appendix A.

Table 3 provides the mean values for the variables used in the regression. The homes on land originally designated as trust land are on the even-numbered blocks in Palm Springs. The log real estate value is 11.79 for trust lands and 11.84 for fee-simple lands—which is statistically significant at the 1 percent level. Trust lands also differ significantly from fee-simple lands in their composition. Trust lands have a higher proportion of condominiums than do non-Indian

<sup>11</sup> The values for housing in the census data cover all homes in Palm Springs, including trust land homes. Therefore, the average home value on fee-simple lands may actually be higher than reported in Table 2. The trust land value of homes in 1960 considers only block 14 in Palm Springs. This downtown location was the most highly developed and populated trust block in Palm Springs before 1960; therefore, it should be an upper limit on the value of trust land housing for that time period. The other trust blocks in the 1960 census do not have consistently reported housing values and are not used in this calculation.

Table 3  
Means of Cross-Sectional Variables by Original Designation of Land Status, 2004

Variable	Trust (N = 14,488)		Fee Simple (N = 15,524)		<i>t</i> -Test for Differences in Means
	Mean	SD	Mean	SD	
Log assessed value	11.79	.57	11.84	.73	-6.58
Trust land today dummy	.51	.50	.00	.00	127.09
Trust land originally dummy	1.00	.00	.00	.00	
Condominium dummy	.64	.48	.24	.43	76.13
Bedrooms	2.37	.76	2.85	1.17	-41.83
Bathrooms	1.95	.57	2.09	.80	-17.35
Pool dummy	.21	.41	.38	.48	-32.88
Air conditioning dummy	.94	.23	.78	.42	40.53
Garage dummy	.63	.48	.69	.46	-11.06
Stories	1.12	.36	1.11	.37	2.37
Age of structure	26.14	9.77	26.06	16.81	.50
Log lot square feet	7.99	.93	8.73	.96	-67.74
Log structure square feet	7.28	.37	7.39	.43	-23.68
Log density of structures per square mile	7.29	.63	7.04	.47	39.13
Apartments on block	4.47	4.48	20.22	23.55	-79.17
Condominiums on block	922.96	416.56	203.79	202.18	192.21
Hotels on block	.27	.45	3.54	7.55	-52.05
Commercial enterprises on block	37.90	54.50	38.33	41.71	-.77
Mobile homes on block	.18	2.37	.41	.73	-11.52
Single-family residences on block	545.82	466.70	754.27	423.32	-40.57
Vacant lots on block	131.86	63.00	207.48	131.75	-62.72

lands. Trust lands also have smaller lot sizes than homes located on nontrust lands. Apartment density is higher for fee-simple lands, but condominium density is larger for trust lands. Finally, fee-simple lands appear to have a higher concentration of hotels.

#### 4.2. Regression Analysis for Original Trust Land Assignment

Table 4 shows a hedonic regression of log real estate value on the housing and land parcel characteristics, with trust land status as the explanatory variable of interest. The basic hedonic regression is as follows:

$$\log \text{Real Estate Value}_i = \alpha + \beta \times \text{Trust}_i + \mathbf{X}_i \delta + \varepsilon_i. \quad (1)$$

If selection is responsible for the difference in average real estate value, then the estimated coefficient on the trust land status variable should be statistically significant. In equation (1), the vector  $\mathbf{X}$  represents all of the housing characteristics for each structure (age, size, number of rooms, and various housing amenities) as well as location and environmental indicator variables, and  $\varepsilon$  represents the standard mean zero error term. The location and environmental indicator variables measure the community amenities in the surrounding area, such as the number of adjacent hotels, commercial enterprises, mobile homes, or apartment complexes; the log of real estate value is simply the value of the

Table 4  
Ordinary Least Squares Regression of Log Value of Real Estate  
with Original Trust Land Assignment

Dependent variable	Coefficient	t-Ratio
Trust land originally dummy	.009	.188
Condominium dummy	.035	.560
Bedrooms	-.023	-1.228
Bathrooms	.089	5.441
Pool dummy	.181	7.031
Air conditioning dummy	.060	1.637
Garage dummy	.106	3.919
Stories	-.010	-.342
Age of structure	-.006	-4.666
Log lot square feet	.088	2.705
Log structure square feet	.833	37.938
Log density of structures per square mile	-.077	-1.232
Apartments on block	-.004	-4.011
Condominiums on block	.000	.773
Hotels on block	.011	3.371
Commercial enterprises	.000	.895
Mobile homes on block	.000	.019
Single-family residences	.000	.437
Vacant lots on block	.000	-.261
Constant	5.306	9.222

Note. Values are robust standard errors clustered at the census tract level. Year sold and location dummies are included.  $N = 30,012$ ;  $R^2 = .723$ .

real estate contained in the county tax assessor's data for both trust and fee-simple lands.

The trust variable indicates whether a home is located on the originally assigned trust lands. Figure 1 indicates that there was an equalization of treatment with respect to the assignment of land parcels—the land was divided into evenly sized square-mile parcels and numbered accordingly. Major roadways divide the desert into square blocks as originally assigned in the late 1800s. It is therefore reasonable to infer that there is no relationship between the value of real estate today and the original assignment of trust or fee-simple status. I expect the coefficient on trust land to be equal to zero in the current time period given that there is no evidence for selection on land quality.

In Table 4, the coefficient on trust land is small, less than .01 in log points and not significantly different from zero. Accordingly, the residual 13 percent mean difference in real estate values for trust and fee-simple lands in 2004 is explained largely by the difference in housing characteristics. Housing composition drives the differences in average real estate values that are observed in Table 2. There are no differences in land value, as expected.<sup>12</sup>

<sup>12</sup> The other variables are consistent with other hedonic housing regressions, and I briefly note a few of them here. The log of the square footage of the house is very large and statistically significant; a 1 percent increase in square footage results in an increase of .82 percent in the value of the home. The lot size has a positive and statistically significant impact on the log value, but only a relatively

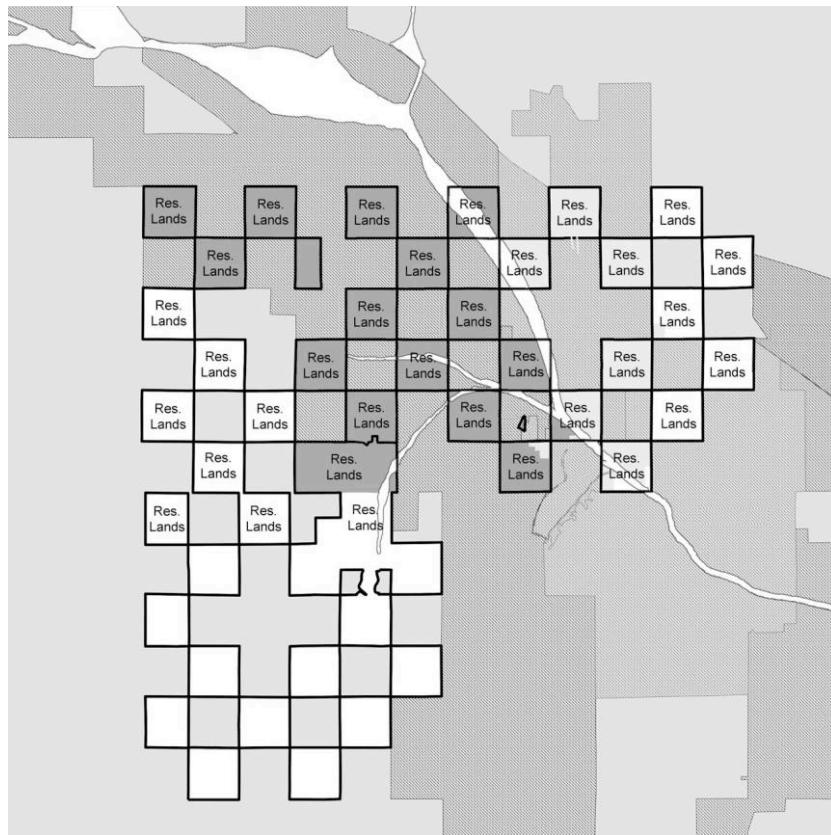


Figure 1. Census block map of Palm Springs, California, and Agua Caliente Reservation (U.S. Census Bureau 2000a).

#### 4.3. Controlling for Nonrandom Trust Land Conversion and Sales

The results from the previous section indicate that the differences in average real estate values between trust and fee-simple lands are not due to selection on land quality. In this section, I examine the role of selected trust land sales after

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small impact overall. A 1 percent increase in the size of the lot is associated with an increase of .087 percent in the value of the overall parcel. An increase in the number of bedrooms, given a fixed size of house, decreases the overall value, while an increase in the number of bathrooms, even for a house of fixed size, tends to increase the value. As expected, pools, garages, and air conditioning all tend to increase the value of a home, and older homes have lower values. The surrounding characteristics matter a great deal as well. A home located on a block with apartment buildings tends to have a lower value. However, being located on a block with more condominiums, hotels, commercial enterprises, or single-family homes tends to increase the value of a home. Finally, homes located on a block with many vacant lots have lower overall values.

Table 5  
Ordinary Least Squares Regression of Log Value of Real Estate  
with Current and Converted Trust Lands

Dependent Variable	Coefficient	t-Ratio
Current trust land	.052	1.160
New fee-simple land	-.044	-.672
Condominium dummy	.038	.627
Bedrooms	-.020	-1.145
Bathrooms	.087	5.705
Pool dummy	.184	6.618
Air conditioning dummy	.053	1.499
Garage dummy	.094	3.513
Stories	-.004	-.134
Age of structure	-.007	-4.535
Log lot square feet	.093	2.771
Log structure square feet	.824	33.863
Log density of structures per square mile	-.094	-1.605
Apartments on block	-.004	-5.218
Condominiums on block	.000	.831
Hotels on block	.011	3.235
Commercial enterprises	.000	.975
Mobile homes on block	.001	.255
Single-family residences	.000	1.190
Vacant lots on block	.000	-.168
Constant	5.415	9.941

Note. Values are robust standard errors clustered at the census tract level. Year sold and location dummies are included.  $N = 30,154$ ;  $R^2 = .724$ .

1960 in explaining the residual differences in trust and fee-simple real estate values in 2004.

After 1960, individual Agua Caliente landowners, with the approval of the commissioner of the Bureau of Indian Affairs, began to convert their trust lands into fee-simple status and to sell those lands to non-Indians. Given that these trust land conversions and sales did not occur randomly, there is a concern that these newly converted fee-simple lands are driving the convergence in the value of investment found in the previous section. For instance, if former trust land is more valuable than current trust land, this would be evidence against convergence of trust land real estate. Newly converted fee-simple lands would be responsible for the overall increase in real estate value; one could not conclude that the incentive to invest on trust land has converged to that of fee-simple lands.

I create two new variables, Trust Today and New Fee Simple Land; the first variable indicates that a property is currently located on trust lands, while the second indicates that the property is on fee-simple land that was formerly trust land. The omitted category of landownership, as in the previous regression, is Always Fee Simple Land. Table 5 provides the results from the regression and indicates that Trust Today and New Fee Simple Land are statistically insignificant. Therefore, there is no evidence that the conversion of former trust lands contributed to the observed convergence in real estate values.

The results indicate that there is a persistent difference in the level of investment on trust lands. While the value of trust land real estate in 1960 was approximately 19 percent of the value of fee-simple land real estate, by 2004 the value of trust land real estate had increased to 87 percent of fee-simple land real estate. Once I account for the selection in trust land conversion and sales, this difference diminishes further—the value of trust land real estate is approximately 92 percent of fee-simple land real estate. There has been strong convergence in housing investment on Agua Caliente Reservation lands; however, there remains a residual difference in the mean value of real estate by status of about 8 percent.

One potential reason for this continued discounting of trust land real estate may stem from the fact that lease rent payments are not tax deductible for owner-occupants of a home or condominium (Fry and Mak 1984).<sup>13</sup> Mortgage interest payments for owner-occupied housing on fee-simple lands are tax deductible, which makes fee-simple home ownership slightly more attractive. The 8 percent discounting of trust lands may reflect the higher tax burden incurred by non-Indian home and condominium owners who reside on trust land parcels in Palm Springs.

### 5. Conclusion

In this research, I explore the difference that two property institutions, trust and fee-simple status, have on housing investment in Palm Springs, California. I document the underinvestment on Agua Caliente trust lands in 1959 prior to a relaxation of trust land restrictions. Trust land real estate investment lagged that of fee-simple real estate in both the absolute number of homes and the values of those homes. I show that these differences in investment are due primarily to the different investment incentives inherent in the two property institutions and not to land quality or location. After a relaxation of trust land restrictions, the number of homes constructed on trust lands converges to the fee-simple benchmark. In addition, by 2004 the value of these trust land homes converges to within 8 percent of the value of fee-simple housing structures.

<sup>13</sup> Fry and Mak (1984) discuss a slightly different situation in Hawaii, where the value of trust lands is estimated to be slightly higher than fee-simple lands. They indicate that this is driven by the distaste for moving in general and by borrowing constraints. Their results are not exactly applicable to Palm Springs, where land quality and environmental conditions are constant. In their study, the communities selected on the island of Oahu differ dramatically in their location, amenities, and quality. In addition, the assignment of trust land status was not random—therefore, moving from trust land to a fee-simple land home requires moving to a completely different area on Oahu, which may have different environmental conditions and land quality.

## Appendix A

### Data Set Creation

#### *Housing Stock: Time Series*

The data for the time series are composed of five different U.S. Censuses of Housing and Population. The 1950 census provided data on the total number of homes built in Palm Springs; there was no distinguishing between trust and nontrust structures. The 1960 U.S. census provided the first instance of microlevel data for Palm Springs. In order to calculate the total number of homes on either trust or nontrust lands, I used the census block maps and the census block data provided in the census. I used the total count of homes by census block and located these homes using the U.S. census maps by decade. Once I had located the census blocks on the U.S. census maps, I then identified whether a particular census block was located on trust land or fee-simple lands using the Agua Caliente trust land map. In most cases, census blocks did not cross reservation boundaries. When a census block crossed reservation and nonreservation lands, I divided the total number of homes for that census block and added an equal proportion to both categories of land. If there is a bias present in this method, it would tend to inflate the number of homes built on reservation land and is a real concern only for the 1960 census—the base year for Table 1. Only one-fifth of all housing units included in the total trust land housing units fell into this category, and an even smaller number for the fee-simple lands.

The same process was repeated for 1970 and 1980. By the 1970 census, however, far fewer census blocks crossed reservation and fee-simple land boundaries; revisions of census block numbering and dimensions had occurred. Only 7 percent of housing units included in the trust land total were on census blocks that crossed boundaries. From 1980 onward, the census blocks for reservation and fee-simple lands were completely separate.

In order to calculate the stock of homes in 1990 and 2000, I used the American Fact Finder Web page at the U.S. Census Bureau Web site.<sup>14</sup> The 1990 U.S. Census Bureau tables available on the U.S. Census Bureau Web site provided the total number of homes on Agua Caliente lands. Unfortunately, when reporting numbers of homes located in Palm Springs, the Census Bureau reports an aggregate number that includes homes located on the Agua Caliente Indian Reservation. To avoid double counting, I deleted the number of homes located on the Agua Caliente Indian Reservation from the Palm Springs housing totals. The total number of homes, 21,129, is provided in Table 1. I replicated this process, in order to avoid double counting, for the 2000 census data as well.

<sup>14</sup> U.S. Census Bureau, American Factfinder (<http://factfinder.census.gov>). I constructed my search using the following chain: Data Sets, Data Sets with Quick Tables, Geography.

*Housing Values: Cross Section*

The data for the cross-sectional analysis, as described earlier, were purchased from DataQuick, Inc. These data are simply the electronic version of the county of Riverside tax assessor's data. The primary work involved in the creation of the data set used, in addition to the normal cleaning and standardizing of variables, was the creation of a dummy variable to indicate land originally designated as trust land. The data contain information on whether a parcel was located on trust lands in 2004. However, the data do not indicate whether a parcel originally had trust or fee-simple status. In order to correct for the conversion and sale of trust lands, it is necessary to create a variable that indicates previous trust land status. Therefore, I assigned all of the housing units to their original trust or fee-simple statuses.

In order to accomplish this, each section of the tax assessor's plat maps was examined in conjunction with the reservation boundary map of Palm Springs. Each housing unit consists of a unique number assigned by the tax assessor's office that corresponds to the book, section, and lot number for a particular housing unit. I went through each section of the Palm Springs map and found in the tax assessor's plat maps the relevant book, section, and lot numbers for homes that were on lands originally designated as trust lands. These were then selected out from the DataQuick data (which contain data on all of Riverside County). I created a number of data sets, one for each section of either Palm Springs or the Agua Caliente Reservation. I then created a dummy variable to indicate the whether the parcel was originally designated as trust land; the variable equals one if the current housing unit is located on land originally assigned to the Agua Caliente tribe. Once this was completed, I merged the entire data set to create the final cross-sectional data, with dummy variables for current trust land and land originally designated as trust land.

**Appendix B****Tax Assessor Calculation of Trust Land Value**

The cross-sectional data have both the sales values and assessed values for housing units in Palm Springs and on the Agua Caliente Reservation. Trust lands, as described earlier, cannot be sold; therefore, the sales price that is reported to the tax assessor contains only the price of the physical structure and not the value of the land. For fee-simple lands, however, the sales price includes the value of the structure and the land. In order for this work to be meaningful, I need to compare variables that are measuring the same thing across tenure type.

One solution would be to remove the value of the land from the sales value of the fee-simple properties. This information is not available in the data; it would require estimating some sort of value function for fee-simple lands and then subtracting this amount out. The other alternative is to estimate the value of trust lands and add this amount to the sales price of housing units located

on trust properties. In essence, this is exactly the process that the tax assessors use in estimating an assessed value for homes on trust lands.

The county tax assessor is charged with “estimat(ing) the price a leasehold would bring on an open market under conditions in which neither buyer nor seller could take advantage of the exigencies of the other” (California State Board of Equalization 2002, chap. 3). In addition, I spoke with several tax assessors in the county tax assessor’s office and with private firms engaged in assessments in Palm Springs. The primary method for creating the present value of a leasehold interest is the sales approach method.

Once the purchase price of a housing structure is reported, a present-value amount is added to the price in order to determine total assessed value for trust lands. The calculation of the present value of the land proceeds as follows: the assessor receives information on the lease agreement signed by the lessee and lessor. These lease agreements are negotiated between the two parties and can be assumed to contain market rates for land use in the area. A present-value calculation incorporates the duration of the lease, the annual lease amount paid, and the discount rate. The discount rate is calculated by looking at either the market rate of return on comparable possessory interests or the fee-simple market rates of returns or by using a weighted average of capitalization rates for debt and equity. In any case, these three different methods provide a discount rate that is market determined.

Finally, the present value of the lease (land value) and the sales price are added to provide the assessed value for a housing unit located on trust lands. As all of the components are market determined, the data should accurately reflect the true costs of land. This assessed value allows me to conduct the research with a dependent variable that measures the same items: physical housing structure and land value.

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