Tsukuba Economics Working Papers
No. 2015-001

Does Land Lease Tenure Insecurity Cause Decreased Productivity and Investment in the Sugar Industry? Evidence from Fiji

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March 2015

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Does Land Lease Tenure Insecurity Cause Decreased Productivity and Investment in the Sugar Industry? Evidence from Fiji*

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Does land lease tenure insecurity cause decreased productivity and investment in the sugar industry? To answer this question, the present study examined the impact of weak formal tenure lease arrangements on tenants' investment and the productivity of sugarcane in Ba province, Fiji. After controlling for potential endogeneity in the choice of lease tenure using instrumental variables (IV), it was shown that tenants under insecure lease tenure (expiring in 0–5 years) achieve significantly lower yields of sugarcane, by 9–11 tonnes per hectare, and plant smaller areas of new sugarcane, by 0.19–0.25 hectares on average, than do tenants under secure lease tenure. Insecure lease tenure also negatively affects chemical fertilizer use, although this impact is not statistically significant. An intervention to improve tenure security would likely enhance the production efficiency of and investment in the Fijian sugarcane industry.

Key words: Fiji, Investment, Land, Sugarcane, Tenure Insecurity

* The authors would like to thank the seminar participants at the University of Tsukuba for their constructive comments and the Fiji Sugar Cooperation and Ministry of Agriculture of Fiji for allowing the use of their data and providing advice. This research was conducted with financial support from the Asian Development Bank.
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1. Introduction

Land tenure security is often considered essential for poverty reduction, improvement in economic growth, and development (World Bank, 2014). Empirical evidence from sub-Saharan and Asian countries suggests that informal tenure arrangements undermine farmers' incentives to undertake land-specific investment and cause great losses in productivity (Gavian and Fafchamps, 1996; Place and Otsuka, 2001; Jacoby et al., 2002; Deininger and Ali, 2008; Goldstein and Udry, 2008). To improve tenure security, international organizations such as the World Bank, International Monetary Fund (IMF), and European Union (EU) often promote the formalization of tenure through titling, registration, and formal lease agreements (see Besley, 1995; Jacoby and Minten, 2007; Ali et al., 2012).

While many previous studies have explored the impacts of formal ownership tenure arrangements, their results are ambiguous. Several studies have found that attempts to formalize tenure through land certification and registration programs significantly increase tenure security, land-related investment, and supply of land to the rental market (Banerjee et al., 2002; Deininger at el., 2011). Conversely, others have shown that formal land titling has no significant effects on plot-specific investment compared to plots without titles (Jacoby and Minten, 2007; Deininger and Ali, 2008; Suyanto et al., 2002). Furthermore, despite the emphasis placed on formal ownership tenure agreements, relatively little evidence exists regarding the quantitative impact of lease tenure insecurity. Relevant studies include those of Gavian and Ehui (1999), Jacoby and Mansuri (2008), and Abdulai et al., (2011), who showed that tenants under informal fixed-rent lease contracts achieved lower investment levels and productivity compared to owners of cultivated plots because of landlords' failure to commit to future lease contracts, thus not rewarding tenants for their investment.

Several studies have also indicated that results on the impacts of both informal and formal land tenure on investment and productivity may be biased because of reverse causality or potential endogeneity in tenure choice. Hence, recent research has considered the endogeneity of tenure arrangements to examine the true impacts of tenure insecurity and formal land tenure systems (Besley, 1995; Brasselle et al., 2002; Deininger and Jin, 2006; Jacoby and Mansuri, 2008; Abdulai et al., 2011; Ali et al., 2012).

In this study, we investigate the impact of lease tenure insecurity under formal lease arrangements on tenant investment and sugarcane productivity in Fiji by controlling for the endogeneity in tenure choice. The sugar industry is important to Fiji's economy because it contributes to the country's GDP and provides income to approximately 200,000 people in rural areas (IMF, 2011). Sugarcane production, however, has continually declined over the past decade. Previous studies from Fiji have identified that weak tenure arrangements under formal leasing systems reduce investment and sugarcane yield, although these analyses have generally been descriptive (Lal et al., 2001; Naidu and Reddy, 2002; Narayan and Prasad, 2005; Prasad and Tisdell, 2006)[1].

We investigate the economic implications of tenure insecurity on yield (tonnes per hectare), chemical fertilizer use (kilograms per hectare), and newly planted cane (hectares) using household data from Ba province, Fiji. The three major land tenure systems in Fiji are Freehold (privately owned), State (government owned), and iTaukei land (communally owned)[2]. Land

[1] The only exception is Prasad and Tisdell (2006), who used the ordinary least squares (OLS) method to show that tenants whose leases expired within ten years achieved significantly lower yield and were less likely to invest in capital and maintain soil conservation than were tenants under secured leases. Although Prasad and Tisdell (2006) contributed to the literature by examining tenure insecurity under formal leasing systems, they did not consider possible endogeneity bias in tenure choice.

[2] The iTaukei lease was previously known as the native lease, while the State lease was previously referred to as the Crown lease.

cannot be sold permanently (except for Freehold land), and individuals can only obtain usufruct rights to land by leasing it under formal lease agreements. The Agricultural Landlord and Tenants Act of 1977 (ALTA) allows for land leases of 30 years under both the State and iTaukei arrangements. Although ALTA protects tenants during the lease period, iTaukei lease tenants are less secure than are State tenants. ITaukei tenants lack a provision for lease extension or renewal when leases are expiring, while State tenants are able to review their lease contracts. Consequently, weak lease arrangements under the iTaukei tenure leasing system may discourage land-specific investments and create production inefficiency, especially when leases are expiring. We hypothesized that farmers under iTaukei tenure would decrease their long-term investment, thereby achieving lower sugarcane productivity; when their leases were due to expire within 5 years. We controlled for endogeneity in tenure choice using an instrumental variable (IV) method.

The structure of the paper is as follows. Section 2 describes the background of the land tenure system and sugar industry in Fiji. Section 3 explains the data and study site. Section 4 provides descriptive analysis. Section 5 presents the empirical model and estimates the impacts of tenure insecurity on yield, fertilizer use, and newly planted cane area. Finally section 6 concludes the paper.

2. Background

2.1 Sugar Industry in Fiji

The sugarcane industry in Fiji was developed by the Colonial Sugar Refining Company (CSR), which owned and managed four sugar mills from 1879 to 1972 (Lal et al., 2001, Naidu and Reddy, 2002). The CSR initially grew its own sugarcane on state-owned land and employed

Indian laborers, who were brought to Fiji from India by the British. Between 1879 and 1916, over 60,000 Indians worked on the plantations under contracts (indenture system). These laborers were later settled as independent smallholder farmers on an average of 4 hectares of State land after the indenture system was abolished in 1916 (Moynagh, 1978). In 1973, the CSR sold its interest to the Fiji Sugar Corporation (FSC), which is fully owned by the government. The FSC buys sugarcane from farmers, processes it into raw sugar, and sells it to the UK in European market under the Economic Partnership Agreement (EPA). Of the proceeds from these sugar sales, 70% is distributed to farmers as sugarcane payments (FSC, 2010).

Sugarcane became a priority industry for Fiji's economy during the 1970s after the country's independence (Narayan and Prasad, 2005). Relatively high sugar export earnings (70% of total exports) were recorded during that period (IMF, 2011). The number of farmers increased gradually from 16,995 in 1975 to over 22,000 by 1995 (FSC, 2000). As shown in Figure 1, the FSC achieved its highest sugar production (over 0.5 million tonnes) in 1995. However, production has recently declined. Harvested area dropped from 66,000 hectares in 1999 to 49,000 hectares in 2009. This setback is believed to be a consequence of the uncertainty and non-renewal of iTaukei leases that had begun to expire in 1997[3] (Lal et al., 2001; Naidu and Reddy, 2002; Prasad and Tisdell, 2006). Although successive governments have attempted to boost sugarcane production, these efforts have been futile. The EU, as the major player in Fiji's sugar industry, has called for land lease reforms to increase productivity from the current yield of 46 tonnes per hectare to 65 tonnes per hectare (EU, 2013).

[3] Note that tenants who were issued a ten-year lease before ALTA came into effect in 1977 were granted a single extension of 20 years upon lease expiry (Government of the Republic of Fiji, 1978, Cap.270:13.1). Therefore, the first lease expiry was experienced by iTaukei tenants in 1997.

2.2 Land Tenure System in Fiji

Fiji's current land tenure system was established under British colonial rule between 1874 and 1940[4]. As previously mentioned, three types of land tenure exist in Fiji: Freehold, iTaukei, and State. Freehold land comprises 8% of the total land and is privately owned, mainly by Europeans. Only 2% of Freehold land is owned by Indians and used for agricultural purposes. These Indians purchased Freehold land from Europeans in the 1930s after the Europeans divested from sugarcane farming (Gillion, 1977). Freehold land follows the formal tenure system and can be easily bought and sold (Rakai et al., 1995).

However, other land cannot be sold permanently, either by sale, grant, transfer[5], or exchange, as stipulated in the 1970, 1991, 1997, and 2013 constitutions of Fiji, respectively. Individuals must rent State or iTaukei land for commercial, industrial, residential, or agricultural purposes on lease agreements under legal contracts. Over 87% of total land, now known as iTaukei land, was awarded to indigenous Fijians under the Deed of Cession agreements of 1974. This land is owned communally by several landowning units referred to as clans or *mataqali*[6]. This iTaukei land follows the formal lease system and is available for leasing to nonindigenous and indigenous people outside the *mataqali*. The iTaukei Land Trust Board (TLTB) is a statutory body responsible for administering the land, issuing leases, and collecting and distributing rents to the beneficiaries on behalf of the iTaukei land owners.[7] The remaining 5% of total land is State land and is owned by the government. State land is also offered for leasing under formal

[4] Fiji was a British colony from 1874 to 1970Ward, 1969).
[5] Although transfer of lease may be allowed, the ownership of State land remains with the government and that of iTaukei land remains with landowners.
[6] A total of 788 clans exist in Ba Province (Singh and Reddy, 2007), and the number of members in each clan varies from several hundred to over a thousand (Lal et al, 2001).
[7] Although iTaukei land is owned by indigenous Fijians, administration, lease issuing, and rent collection is managed by the TLTB. The TLTB deducts 20% of rent income as administrative costs (Prasad and Tisdell, 2006).

lease agreements. The Ministry of Lands office is the statutory body responsible for issuing State leases and collecting rent (Government of the Republic of Fiji, 1978, Cap.132).

Since 1977, both State and iTaukei leases for sugarcane cultivation have been issued for 30 years under ALTA. ALTA was introduced to rationalize the leasing of all agricultural land (Lal et al., 2001). All tenants are charged a fixed rent, up to 6% of the unimproved capital value, according to ALTA provisions. The most important difference between iTaukei and State land is that leases are renewed automatically only for State tenants, although the lease period is same under both tenure systems[8].

3. Data and Study Site

This paper uses cross-sectional data for Ba province from the National Agriculture Survey (NAS), conducted by the Ministry of Agriculture of Fiji from October to November 2009. Ba province is the most important sugarcane area in Fiji and contains two mills, called Lautoka and Rarawai. Over 65% of the total sugarcane produced in Fiji comes from this province (Gillion, 1977; FSC, 2010). The main crop grown in Ba is sugarcane because of lease restrictions, although small areas are allotted for growing other crops, such as root crops and vegetables, and raising livestock for subsistence use. All three tenure systems exist in Ba province, and sufficient variation in tenure duration exists to test the hypothesis regarding differences in tenure insecurity between iTaukei and State leases.

The area covered by the NAS was stratified into 76 segments of 1 km^2 using a geographical information system (GIS). A special segment was created for large farms and for those under Freehold tenure. Households were selected randomly from each segment. From a

[8] State tenants reapply for lease renewal, while iTaukei tenants apply for a new lease upon lease expiry (Government of the Republic of Fiji, 1978, Cap270; personal communication with Ministry of Lands, 2014).

total of 1687 selected households, only 719 households cultivated sugarcane. After excluding those with missing values, we were left with 658 households from 58 segments that could be used for analysis. The NAS surveyed the general characteristics of households and their agricultural activities. Additional information on the distances to land offices and mills, tenure and lease expiry, land holdings, fertilizer use, and sugarcane production for 2009 was obtained from the FSC and matched with the NAS households by each farmer's sugarcane contract numbers. Each household cultivated sugarcane under only one tenure type. Households rarely possess land under two or more tenure types because tenure is determined geographically based on a historical process we will discuss later.

Table 1 displays the distribution of plots by the share of owner and tenant cultivators by tenure type in our data set. Of the total cultivators, 87% are tenants, while 13% are owners. Under iTaukei tenure, 95% of the cultivators are tenants. Among iTaukei tenants, 80% are Indians, while 20% are Fijians. Freehold land under sugarcane cultivation is mainly owned by Indians, although some landowners have rented out their land. We found that 11% of cultivators under Freehold tenure are tenants, while 89% are owner-cultivators. All State lands are leased out, and 98% of their tenants are Indians.

4. Descriptive Analysis

To provide better insights on the impacts of tenure insecurity, we summarize the productivity of sugarcane and investment in Table 2. Sugarcane is a long-term crop that matures in 12–14 months after planting and can be harvested for 5–7 consecutive years. On average, the yield from newly planted cane is 70 tonnes per hectare, while that from "*ratoon"* (roots left underground) cane is 53 tonnes per hectare; however, productivity declines as ratoon ages (Lal et

al., 2001). Thus, to test our hypotheses, we first divided the iTaukei and State leases into three categories based on years of lease expiry (0–5, 6–10, and over 10 years) and considered the overall average (0-30 years). Then, we conducted *t*-tests on the mean differences for yield, chemical fertilizer use[9], and newly planted cane area between iTaukei and State leases, that is, the differences between columns (a) and (a^1), (b) and (b^1), (c) and (c^1), and (d) and (d^1). The *t*-tests showed significant differences between the iTaukei and State tenants in yield and chemical fertilizer use when leases expired in 0–5 years and for the overall average (columns a and d), but when leases expired in 6–10 or over 10 years. On average, for leases expiring in 0–5 years, iTaukei tenants achieved a yield of 40.00 tonnes per hectare and applied 504.50 kilograms of fertilizer per hectare, while State tenants achieved a yield of 50.70 tonnes and used 627.60 kilograms of fertilizer per hectare. State tenants achieved higher productivity and fertilizer use, probably because of their assurance of lease renewals. However, we did not observe a statistically significant difference between iTaukei and State tenants for the size of newly planted cane area. Based on these observations, we developed the following testable hypothesis:

Hypothesis: *Yield, chemical fertilizer use, and newly planted cane area of iTaukei tenants will be lower when leases expire within 0–5 years compared to those of State tenants.*

5. Empirical Analysis

5.1 Empirical Model

We also conducted regression analyses to investigate the impacts of weak tenure on productivity and investment. The dependent variables are yield of sugarcane (tons per hectare), chemical

[9] Chemical fertilizer is the only source of nutrients applied to sugarcane farms to maintain soil fertility.

fertilizer use (kg per hectare), and newly planted cane area (ha). The two main independent variables of interest are a dummy for iTaukei lease, which takes a value of 1 if the tenure is iTaukei, and a dummy variable for iTaukei lease that expires in 0–5 years, which also takes a value of 1 if the tenure is under iTaukei and the lease expires in 0–5 years. To control for labour and human capital endowment, we included a dummy for the secondary education of the household head (1 if the household head had acquired up to secondary school or higher education, 0 for primary school or no education), age of the household head, and number of household members by age groups. A dummy for tractor ownership (1 if the household owned a wheeled tractor) and total land holdings (hectares) were included to assess any wealth effects (e.g., Gavian and Fafchamps, 1996; Goldstein and Udry, 2008; Ali et al., 2012). A total of 18 sector (subdistrict) dummies were included to capture other unobservable sector-level characteristics such as soil quality, slope, and rainfall[10]. Detailed descriptive statistics are presented in appendix Table A1.

Although households have limited options in tenure selection, other unobserved tenant and owner heterogeneities such as risk aversion, farm implements, or management skills of the cultivator may result in endogeneity of tenure choice (Jacoby and Mansuri, 2008; Abdulai et al., 2011). In the presence of endogeneity, where tenure choice is correlated with the error term, OLS estimates become biased in estimating tenure's true impacts on investment and productivity. Essentially, we controlled for the endogeneity of two endogenous variables (iTaukei leasing and iTaukei tenure expiring within 0–5 years) using instrumental variables (IV) and estimated the results using both OLS and IV methods for robustness checks.

[10] The 19 sectors are Drasa (control), Drumasi, Yaladro, Tagitagi, Varavu, Veisaru, Koronubu, Moto, Rarawai, Naloto, Varoko, Lovu, Lautoka, Saweni, Natova, Legalega, Meigunyah, Malolo, and Qeleloa.

A suitable IV is a variable that strongly influences tenure choice but is unrelated to unobserved plot characteristics (Jacoby and Mansuri, 2008). Distance from the plot to the land office in kilometers is a suitable candidate for an IV for iTaukei tenure because of historical circumstances. Land boundaries were physically marked by the land office after its establishment during colonial days (France, 1969, Gillion, 1977); thus, the majority of State land is found near land offices. Regarding exclusion restriction, the question arises whether the IV explains any differences in plot quality or factors such as market access. On average, the quality of land does not differ significantly among tenure types because over 90% of land under sugarcane cultivation is Class III[11] (Lal et al, 2001), suggesting that the soil quality in remote areas is similar to that near land offices. Farmers deliver harvested cane to the mills via trucks, tractor-trailers, or a railway network owned by the FSC that is accessible to most sugarcane areas[12]. FSC delivers fertilizer to the farmers free of cost from the factory located near Lautoka mill. In fact, the two mills and land offices are located in different districts geographically. Thus, we used distance to the mill as a proxy of market access, while we used distance to the land office as an IV for tenure choice.

To construct an additional IV for iTaukei tenure expiring in 0–5 years, the dummy of lease expiry in 0–5 years was interacted with distance to the land office. Note that we treat the years of expiry for tenure as an exogenous variable. Although tenants may terminate their leases, they are not compensated for any improvements made on the land during the lease term[13]. More

[11] Class III plots are shallow, moderately fertile, and require soil erosion control measures and fertilizer application (Lal et al., 2001).
[12] Farmers using trucks to deliver cane receive a subsidy for the cartage cost per kilometer travelled beyond the nearest "*pass-out* point" (railway station). Those using railways pay a cartage cost up to the pass-out point (FSC, 2010).
[13] ITaukei tenants may be allowed an additional year to harvest any unharvested crops upon lease expiry if approved by the TLTB; however, this clause rarely applies (Prasad and Tisdell, 2006).

desirably, tenants may transfer their leases to an immediate family member or an unrelated individual under the provisions of ALTA. However, the preconditions of lease transfer, which require the plot to be dispute- and mortgage-free, as well as high search and relocation costs for alternative land, reduce the probability of transfer (Government of Fiji, 1978, Cap.131; Naidu and Reddy, 2002). Short-term leases are insecure and do not encourage tenants to invest in long-term investments or use them as collateral (Lal et al., 2001). In addition, the market for iTaukei leases expiring in 0–5 years is very small because the lease term is not extended even in the event of transfer according to the ALTA. In fact, as shown in Table 2, over 80% households under iTaukei have inherited land. Although leases are renewed for State tenants upon lease expiry, the transfer rate of State leases is also low because finding alternative State land is almost impossible given its limited availability. Note also that the years of expiry are not be extended after a family member inherits the land. Thus, lease expiry in 0–5 years is treated as an exogenous variable.

5.2 Empirical Results

Table 3 shows the first-stage estimation results on determinants of leasing tenure choice. The dependent variable is iTaukei tenure in columns (1) to (3) and iTaukei tenure expiry in 0–5 years in columns (4) to (6). To confirm the credibility of our results, we conducted our analysis with full sample and sub-group analysis. Columns (1) and (4) include the full sample, for which the base categories included Freehold and State tenants. For models (2) and (5), we dropped the Freehold and iTaukei owners, keeping the State tenants as the reference category. Finally, in

columns (3) and (6), we excluded all Fijian[14] tenants to exclude the impact of ethnicity and compare Indian iTaukei tenants with the control group of Indian tenants under State lease tenure. The 18 sector-level dummies were included as additional controls, and standard errors were clustered at the segment level in all models.

The results demonstrate that distance to land office strongly influences tenure choice. The positive coefficient of this variable in all models suggests that land located far from an office is more likely to be leased under iTaukei, as was expected. Except for distance to mills, which has a significant positive correlation with iTaukei tenure, other household characteristics did not affect tenure choice.

Table 4 reports the estimation results for the impact of tenure insecurity on sugarcane yield. We show the results for both OLS, in columns (1) to (3), and 2SLS, in columns (4) to (6)[15]. The base categories in the columns are the same as those in Table 3. The most important result is that sugarcane yield decreases significantly under iTaukei tenure when leases expire in 0–5 years compared to the reference categories, even after controlling for endogeneity in tenure choice, in columns (4) to (6); this finding is consistent with descriptive evidence. According to these estimates, yield is 9–11 tonnes per hectare lower on average under iTaukei tenure when leases expire in 0–5 years than under State tenure. This result supports our hypothesis that tenure insecurity significantly reduces productivity for iTaukei tenants when the lease is expiring.

The number of household members between 15–65 years positively impacts productivity in models (1), (2), (4), and (5), implying that high labor inputs increase sugarcane yield.

[14] Fijian and Indians are two ethnicities involved in sugarcane cultivation. Differences in productivity may exist because of farming skills, acquisition of farm implements, and input use (Lal et al., 2001; Naidu and Reddy, 2002)
[15] Although we found that endogeneity tests were not significant, we obtained largely consistent results with OLS and 2SLS, and thus it has little impact on our interpretation. The results for the first-stage *F* and endogeneity tests are reported in the tables.

Household heads with higher education generally achieve higher yields than those with primary school or no education. In addition, households who own tractors generally achieve higher yields than those who do not, suggesting the importance of machinery to productivity. Total land holdings have a significantly positive impact on yield. Farmers with large land holdings may have better credit access and use more chemical fertilizer, thus achieving higher yields.

Table 5 presents the estimation results for the impact of tenure insecurity on chemical fertilizer use. All controls and specifications are the same as those reported in previous tables. Because soil quality is maintained only for a single cropping season (Jacoby et al., 2002), we consider chemical fertilizer use as a measure of short-term investment. The results show that both iTaukei tenure and expiry in 0–5 years have significant negative effects on fertilizer use in the OLS estimations. However, these coefficients become insignificant once we control for endogeneity and adjust the standard errors. This finding is consistent with the literature, which shows that tenure insecurity or expropriation risks do not affect the use of chemical fertilizer, which has only short-term impact on soil quality (Jacoby et al., 2002; Jacoby and Mansuri, 2008). Except for total land holdings, which have a significant positive effect, other variables have statistically insignificant impacts on fertilizer use.

In Table 6, we present the estimation results for newly planted cane area with the same specifications and control variables as discussed above. While iTaukei tenure has no effect, iTaukei lease expiry in 0–5 years has significantly negative impacts on newly planted cane area in all models. The estimated coefficients suggest that insecure tenants significantly reduce their investment in newly planted cane area, by 0.19–0.25 hectares on average, compared to State tenants. This result supports our hypothesis that tenure insecurity significantly reduces the long-term investment in planting new cane area for iTaukei tenants when their leases are expiring.

While total land holdings have a significant positive effect, the coefficients of other variables are generally insignificant.

6. Conclusion

In view of declining sugarcane production and increasing poverty in sugarcane belt areas, we examined the impact of weak tenure leases on sugarcane yield, chemical fertilizer use, and newly planted cane area using micro-level data from Ba Province, Fiji. We compared tenure security between three tenure types under the formal land lease system. After controlling for endogeneity in tenure choice, the results reveal that lease tenure insecurity has a significant and negative impact on productivity and investment in newly planted cane. On average, iTaukei tenants with leases expiring in 0–5 years achieve lower productivity, by 9–11 tonnes per hectare, and make less investment in newly planted cane, by 0.19–0.25 hectares, compared to State tenants.

Tenure insecurity also has negative impacts on chemical fertilizer use for iTaukei tenants with leases expiring in 0–5 years compared to State tenants, although the coefficients are statistically insignificant. Because chemical fertilizer is likely a short-term investment, weak tenure security may not significantly affect fertilizer use (Li et al., 1998; Jacoby et al., 2002; Jacoby and Mansuri, 2008; Abdulai et al., 2011).

Overall, the study found that simply issuing leases under formal agreements did not affect investment and productivity. However, tenure security becomes a concern for iTaukei tenants when their leases are expiring, impacting productivity and long-term investment. Insecurity arises because of a lack of protection for tenants against the threat of eviction as leases expire. Given that land cannot be sold permanently under current Fijian law, tenants likely do not have the rights to be granted full ownership. However, tenure security may be strengthened through

alternative measures such as providing legal protection to long-term occupants and offering lease extensions; these practices will enhance investments and improve the production efficiency of the sugarcane industry in Fiji.

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Table 1. Land tenure distribution by tenure type

Variable Description	Full Sample	Freehold	State	iTaukei
Share of Owner Cultivators (%)	12.6	89.0	0.0	4.8
Share of Indians among owners (%)	80.7	100	0.0	0.0
Share of Fijians among owners (%)	19.3	0.0	0.0	100
Share of Tenant Cultivators (%)	87.4	11.0	100	95.2
Share of Indians among tenants (%)	88.2	100	98.4	80.0
Share of Fijian among tenants (%)	11.8	0.0	1.6	20.0
Observations	**658**	**75**	**246**	**337**

Table 2. Mean differences for productivity, investment, and land acquisition between tenure by years of expiry

Variable Description	iTaukei Years of Lease Expiry				State Years of Lease Expiry				Freehold
	0–5 yrs (a)	6–10 yrs (b)	>10 yrs (c)	Average (d)	0–5 yrs (a)[1]	6–10 yrs (b)[2]	>10 yrs (c)[3]	Average (d)[4]	Average (e)
Yield (tonnes/ha)	40.0***	48.0*	50.3	48.0**	51.4	54.0	53.1	53.0	54.8
Chemical fertilizer use (kg/ha)	504.5**	598.5	610.9	587.7***	627.6	641.3	655.5	647.0	660.3
Newly planted cane (ha)	0.20	0.45	0.35	0.32	0.24	0.38	0.33	0.33	0.25
Household land status (1 if inherited, 0 if purchased)	0.82	0.86	0.80	0.81*	0.80	0.81	0.90	0.86	0.88
Observations	71	22	244	337	46	57	143	246	75

Notes: *, **, and *** indicate significance of the t-statistic at 10%, 5%, and 1%, respectively, for mean differences between (a) and (a)[1], (b) and (b)[2], (c) and (c)[3], and (d) and (d)[4]. (T-test results for mean differences between (d) and (e) and between (d)[1] and (e) are not shown.)

Table 3. First stage estimation of iTaukei and iTaukei tenure expiring within 0–5 years

Variable Description	iTaukei			iTaukei expiring in 0–5 years		
	(1)	(2)	(3)	(4)	(5)	(6)
Distance to land office from plot (km)	0.03	0.03	0.03			
	[3.09]***	[3.23]***	[2.91]***			
Distance to land office* leases expiring in 0–5 years				0.09	0.09	0.07
				[4.06]***	[4.05]***	[3.99]***
Distance to mill (km)	0.03	0.03	0.03	0.01	0.01	0.01
	[3.85]***	[4.09]***	[4.57]***	[2.05]**	[2.02]**	[3.26]***
Age of household head	0.00	0.00	0.00	0.00	0.00	0.00
	[0.01]	[0.02]	[0.22]	[0.29]	[0.26]	[0.83]
Household members <15 years	0.02	0.01	0.00	0.00	0.00	0.00
	[1.39]	[0.68]	[0.35]	[0.21]	[0.27]	[0.19]
Household members 15–65 years	0.01	0.00	0.00	0.00	0.00	0.00
	[0.60]	[0.30]	[0.02]	[0.02]	[0.33]	[0.23]
Household members >65 years	-0.04	-0.04	-0.04	0.00	0.00	-0.01
	[1.40]	[1.16]	[1.30]	[0.13]	[0.20]	[0.82]
Household head with secondary/higher education	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[0.39]	[0.36]	[0.41]	[0.52]	[0.49]	[0.50]
Household owns tractor	0.00	0.02	0.04	0.00	0.00	-0.01
	[0.04]	[0.56]	[1.15]	[0.18]	[0.15]	[0.29]
Total land holding (Ha)	-0.01	-0.01	-0.01	0.01	0.01	0.00
	[0.73]	[0.48]	[0.80]	[1.25]	[1.29]	[0.91]
Constant	-0.41	-0.37	-0.45	-0.17	-0.17	-0.27
	[2.93]***	[2.56]**	[3.02]***	[1.72]*	[1.61]	[2.41]**
Sector level dummy included	YES	YES	YES	YES	YES	YES
F statistic (*p*-value)	47.59 (0.00)	32.81 (0.00)	77.57 (0.00)	9.90 (0.00)	8.16 (0.00)	9.43 (0.00)
R-squared	0.44	0.47	0.51	0.44	0.45	0.45
Observations	658	569	499	658	569	499

Notes: *, **, and *** indicate significance of the t-statistics in brackets at 10%, 5%, and 1%, respectively. Columns 1 and 4 include the full sample (Freehold and State are controls), 2 and 5 exclude all Freehold and iTaukei owners (control category is State), and 3 and 6 compare Indian tenants under iTaukei and State leases (base category is State). All models include 18 sector dummies, and SE is adjusted at the segment level.

Table 4. Impact of iTaukei and iTaukei tenure expiring within 0–5 years on yield per hectare (tonnes)

Variable Description	OLS			2SLS		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
iTaukei	-3.92	-2.93	-0.39	-11.12	-7.65	0.94
	[2.10]**	[1.48]	[0.19]	[1.33]	[0.98]	[0.13]
iTaukei expiring in 0–5 years	-6.50	-7.16	-8.04	-8.78	-9.85	-11.19
	[2.27]**	[2.46]**	[2.75]***	[1.93]*	[2.19]**	[2.18]**
Distance to mill (km)	-0.65	-0.76	-0.58	-0.40	-0.59	-0.57
	[2.87]***	[3.27]***	[3.58]***	[1.16]	[1.78]*	[1.89]*
Age of household head	-0.04	-0.02	-0.02	-0.05	-0.02	-0.01
	[0.57]	[0.28]	[0.24]	[0.71]	[0.33]	[0.16]
Household members 15–65 years	0.66	0.70	0.29	0.74	0.72	0.31
	[1.81]*	[1.79]*	[0.78]	[1.93]*	[1.83]*	[0.82]
Household head with secondary/higher education	2.24	1.77	2.70	2.03	1.61	2.68
	[1.72]*	[1.22]	[1.67]	[1.54]	[1.12]	[1.69]*
Household owns tractor	3.34	3.22	1.81	3.22	3.20	1.76
	[2.58]**	[2.30]**	[1.32]	[2.53]**	[2.32]**	[1.30]
Total land holding (Ha)	0.75	0.72	1.01	0.70	0.70	1.03
	[2.31]**	[2.07]**	[2.90]***	[2.08]**	[1.99]*	[2.84]***
Constant	58.88	57.66	57.41	57.03	56.56	56.79
	[12.82]***	[11.13]***	[12.60]***	[10.81]***	[10.29]***	[11.39]***
Sector level dummy included	YES	YES	YES	YES	YES	YES
Kleibergen-Paap Wald *F*-statistic				4.64	5.04	4.00
Endogeniety test (*chi-sq*)	-	-	-	1.70	1.13	0.65
(*p*-value)	-	-	-	(0.43)	(0.57)	(0.72)
R-squared	0.21	0.21	0.22	0.18	0.19	0.22
Observations	658	569	499	658	569	499

Notes: *, **, and *** indicate significance of the t-statistics at 10%, 5%, and 1% respectively [t-statistics in brackets]. Columns 1–3 and 4–6 represent OLS and 2SLS estimations, respectively. The base categories are the same as those employed in Table 3. All models include 18 sector dummies, and SE is adjusted at the segment level.

Table 5. Impact of iTaukei and iTaukei tenure expiring within 0–5 Years on chemical fertilizer use (kilograms/hectare)

Variable Description	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
iTaukei	-37.83	-34.62	-23.30	-47.71	-42.29	24.81
	[2.07]**	[1.87]*	[1.16]	[0.60]	[0.56]	[0.32]
iTaukei expiring in 0–5 years	-59.84	-65.89	-64.20	-81.41	-87.93	-100.63
	[1.61]	[1.77]*	[1.76]*	[1.23]	[1.29]	[1.29]
Distance to mill (km)	-5.02	-5.42	-2.20	-4.46	-4.93	-3.20
	[1.50]	[1.60]	[0.86]	[1.04]	[1.21]	[0.78]
Age of household head	-0.23	0.18	0.00	-0.23	0.20	0.10
	[0.34]	[0.30]	[0.00]	[0.31]	[0.31]	[0.16]
Household members 15–65 years	3.73	3.51	-1.74	3.96	3.59	-1.65
	[0.83]	[0.71]	[0.40]	[0.86]	[0.72]	[0.39]
Household head with secondary/higher education	14.89	7.20	12.89	14.34	6.69	13.51
	[1.13]	[0.51]	[0.84]	[1.02]	[0.46]	[0.86]
Household owns tractor	17.38	16.02	-0.13	17.16	15.91	-1.20
	[1.09]	[0.93]	[0.01]	[1.07]	[0.92]	[0.07]
Total land holding (Ha)	13.68	11.33	12.33	13.64	11.34	12.90
	[3.19]***	[2.87]***	[2.85]***	[3.25]***	[2.90]***	[2.78]***
Constant	660.08	651.15	649.66	653.70	646.00	650.00
	[10.91]***	[9.81]***	[10.25]***	[10.69]***	[9.63]***	[9.65]***
Sector level dummy included	YES	YES	YES	YES	YES	YES
Kleibergen-Paap Wald *F*-statistic	-	-	-	4.64	5.04	4.00
Endogeniety test (*chi-sq*)	-	-	-	0.19	0.18	1.16
(*p*-value)	-	-	-	(0.91)	(0.91)	(0.56)
R-squared	0.17	0.16	0.19	0.17	0.16	0.18
Observations	658	569	499	658	569	499

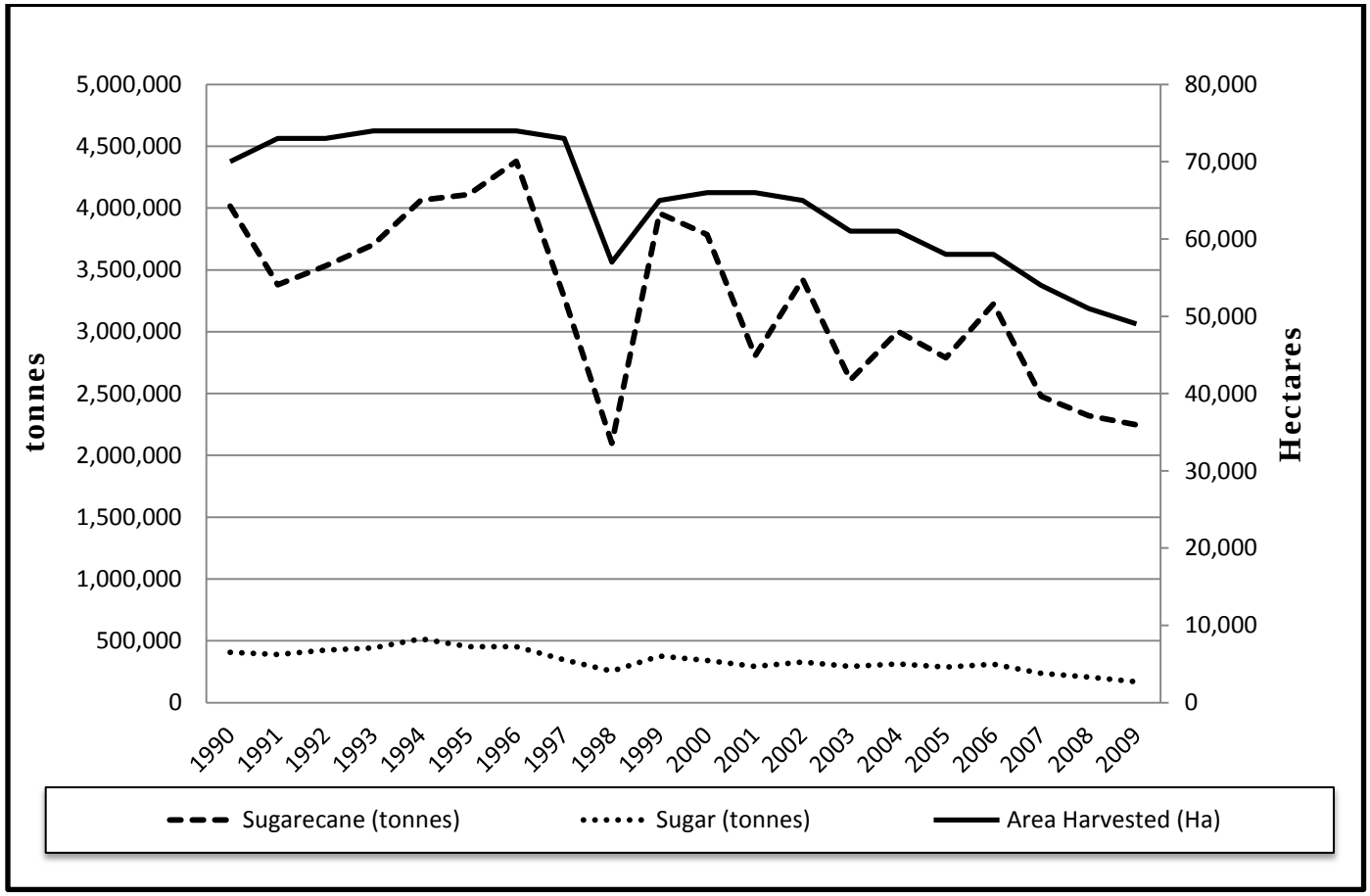
Notes: *, **, and *** indicate significance of the t-statistics at 10%, 5%, and 1% respectively [t-statistics in brackets]. Columns 1–3 and 4–6 represent OLS and 2SLS estimations, respectively. The base categories are the same as those employed in Table 3. All models include 18 sector dummies, and SE is adjusted at the segment level.

Table 6. Impact of iTaukei and iTaukei tenure expiring within 0–5 Years on newly planted cane (ha)

Variable Description	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
iTaukei	0.01	0.00	0.06	0.03	0.03	0.13
	[0.19]	[0.03]	[1.04]	[0.14]	[0.17]	[0.68]
iTaukei lease expiring in 0–5 years	-0.14	-0.15	-0.18	-0.19	-0.20	-0.25
	[2.65]**	[2.86]***	[2.97]***	[2.04]**	[2.22]**	[2.05]**
Distance to mill (km)	0.00	0.00	0.00	0.00	0.00	0.00
	[0.06]	[0.18]	[0.80]	[0.02]	[0.09]	[0.40]
Age of household head	0.00	0.00	0.00	0.00	0.00	0.00
	[0.02]	[0.13]	[0.24]	[0.01]	[0.17]	[0.30]
Household members 15–65 years	0.01	0.01	0.01	0.01	0.01	0.01
	[0.49]	[0.53]	[0.67]	[0.48]	[0.53]	[0.67]
Household head with secondary/higher education	0.06	0.07	0.09	0.06	0.07	0.09
	[1.53]	[1.53]	[1.80]*	[1.47]	[1.48]	[1.77]*
Household owns tractor	0.07	0.06	0.04	0.07	0.06	0.04
	[1.30]	[1.04]	[0.75]	[1.30]	[1.04]	[0.72]
Total land holding (Ha)	0.04	0.03	0.05	0.04	0.03	0.05
	[2.19]**	[1.99]*	[2.29]**	[2.17]**	[1.98]*	[2.25]**
Constant	-0.12	-0.15	-0.26	-0.13	-0.16	-0.27
	[0.69]	[0.79]	[1.27]	[0.74]	[0.84]	[1.35]
Sector level dummy included	YES	YES	YES	YES	YES	YES
Kleibergen-Paap Wald *F*-statistic	-	-	-	4.64	5.04	4.00
Endogeniety test (*chi-sq*)	-	-	-	0.42	0.49	0.47
(*p*-value)	-	-	-	(0.81)	(0.78)	(0.79)
R-squared	0.13	0.12	0.14	0.13	0.12	0.14
Observations	658	569	499	658	569	499

Notes: *, **, and *** indicate significance of the t-statistics at 10%, 5%, and 1% respectively [t-statistics in brackets]. Columns 1–3 and 4–6 represent OLS and 2SLS estimations, respectively. The base categories are the same as those employed in Table 3. All models include 18 sector dummies, and SE is adjusted at the segment level.

Figure 1. Area harvested and production of sugarcane and



Source: Fiji Bureau of Statistics (2014).*Note:* Fiji experienced severe drought in 1998.

Appendix - Table A1: Descriptive statistics of variables used in analysis

Variable	Mean	Std. Dev.
1 if iTaukei tenure	0.51	0.50
1 if State tenure	0.37	0.48
1 if Freehold tenure	0.11	0.32
Age of household head	51.29	11.84
Household members <15 years	0.97	1.22
Household members 15–65 years	3.58	1.58
Household members >65	0.31	0.59
1 if Household head acquired ≥ High School Edu (0 if no or primary school)	0.46	0.50
1 if Household inherited land (0 if purchased)	0.84	0.37
1 if Household owns tractor (0 if hired and/or not owned)	0.27	0.44
Total land holdings (Ha)	4.54	2.32
Area under sugarcane cultivation (ha)	3.46	1.80
Area harvested (ha)	3.33	1.81
Ratoon over 1 year old (Ha)	0.20	0.59
Ratoon over 2 years old (Ha)	0.16	0.39
Ratoon 3 years and over (Ha)	2.73	1.58
Total production (tonnes)	175.29	122.00