

RESEARCH ARTICLE

Unravelling the pastoralist paradox – preferences for land tenure security and flexibility in Kenya

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Abstract

In this paper, we use a discrete choice experiment conducted among pastoralists in four different semi-arid counties in Kenya characterized by different land tenure regimes to analyze how pastoralists make tradeoffs between tenure security and grazing flexibility – the so-called pastoralist paradox. Results show that there is one group of respondents who are desperate for change and seem to prefer either group or private title deeds to their current situation. A second, smaller group has strong preferences for the status quo, which could be driven by their relatively short migration distances. Concerning index-based livestock insurance, the basis risk suffered by insured pastoralists due to underprediction is high, but willingness to pay (WTP) for livestock insurance should still be high enough to ensure maximum uptake, leaving current low uptakes hard to explain. The worry about climate change is high but does not translate into increased WTP for more secure tenure or formal livestock insurance.

Keywords: discrete choice experiment; Kenya; land tenure change; pastoralist paradox; willingness-to-pay

JEL Classification: O13; Q24; Q51

1. Introduction

Drylands – which include hyper-arid, arid, semi-arid and dry sub-humid areas – cover about 40 per cent of the Earth's land surface (Safriel *et al.*, 2005) and are expected to expand in the face of climate change (Huang *et al.*, 2016). More than 2 billion people live in drylands, about 90 per cent of them in low- and middle-income countries (LMIC) (Safriel *et al.*, 2005). Drylands also support about 50 per cent of the world's livestock, which is a key source of food security and livelihoods for people in LMIC areas. Drylands are among the most vulnerable regions globally as they are faced with enduring political and economic marginalization, poverty, inequity, food and nutrition insecurity, land

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and ecosystem degradation, and frequent conflicts. In addition, these socio-ecological systems are very sensitive to climate and environmental change (IPCC, 2019), and the formal as well as informal institutions that govern resource use and rights are often weak.

Many pastoralists who inhabit drylands in East Africa have also been faced with a historically persistent devaluation of their way of life, e.g., the Maasai in Laikipia (Hughes, 2006), and are today politically and economically marginalized communities in this region (Bonfoh *et al.*, 2016). In East Africa, states have tended to treat pastoralism as an anachronistic way of life that produces little economic value. Rather, pastoralists are seen to contribute to environmental degradation by being locked into a tragedy of the commons (Bonfoh *et al.*, 2016; Lind *et al.*, 2016). The perceived low contribution of the drylands to the national economy has led successive governments in Tanzania, Ethiopia, Kenya, and Uganda to, on the one hand, bias the allocation of public resources to agrarian highlands and, on the other hand, to push pastoralists into more sedentary ways of life (Eriksen and Lind, 2009; Kameri-Mbote *et al.*, 2013; Lind *et al.*, 2016). In addition, land alienation has continuously disrupted the viability of pastoralist livelihoods through local, national, and foreign land investments (Fokou and Bonfoh, 2016). In Kenya, the struggle for pastoralist rights to land has been fought within a hostile political and legal environment that has favored sedentary public and private land rights (Kameri-Mbote *et al.*, 2013).

Furthermore, pastoralist systems in Kenya are increasingly exposed to market forces with transformative impacts on pastoralist land, livestock, and livelihoods. The previously common characterizations of rangelands as marginal, remote, and unproductive places have in recent decades given way to an image of these lands as an untapped resource with a development potential that needs to be 'opened up' (Mosley and Watson, 2016; Cormack and Kurewa, 2018). Consequently, pastoralists find themselves increasingly confronted by processes of privatization and fragmentation of land-based resources through infrastructure projects, exploitation of oil and minerals, agricultural expansion, land reforms, and an expanding livestock trade (e.g., Galvin, 2009; Lind *et al.*, 2016; Chimhowu, 2019). The paradox of pastoralists is that they need both secure and flexible land rights (Turner *et al.*, 2016). This means that although privatization leads to more secure tenure conditions, the fragmentation that goes along with it can be very detrimental to flexibility and community peace, and sometimes can escalate into land conflicts.

Indeed, the study region in general has seen a prevalence of conflict between farmers, pastoralists, large-scale ranchers, and wildlife (Government of Kenya, 2008) in the more recent past. This has sometimes reached violent levels in the counties of Laikipia and Baringo. Among the sources of conflict are crop raiding (Government of Kenya, 2008), wildlife predation of and competition with livestock (Woodroffe *et al.*, 2005; Young *et al.*, 2005; Graham *et al.*, 2010), and competition for access to resources such as water and pasture (Campbell *et al.*, 2009). Livestock rustling or raiding is also prevalent (Kaimba *et al.*, 2011; Greiner, 2013).

To provide for the recognition, protection, and registration of community land rights, the Kenyan government signed the Community Land Act into law in August 2016 (Government of Kenya, 2016: 528). By doing so, Kenya has become one of the most recent examples of the attempt to formalize customary, communal land rights in Sub-Saharan Africa (Krantz, 2015; Alden Wily, 2018). Through this Act, the former land ownership categories of private land, government land, trust land, and group ranches

were replaced by the categories of private land, public land, and community land.¹ While advocates of this approach towards strengthening collective land rights points at its merits in terms of inclusiveness and legitimacy (e.g., Cousin, 2007; Freudenberger, 2011; Basupi *et al.*, 2017), critics fear that the new community land act in Kenya will fail to respond to the conditions and requirements of pastoralist ways of life.

The question then becomes: What do pastoralists prefer when it comes to the trade-off between tenure security (private property rights) and flexibility (the availability of and distance to alternative grazing grounds)? Is it more important to have secure tenure rights, even if it involves a fragmented and privatized landscape with long migration routes to alternative grazing grounds in case of drought? Could the increased popularity of index-based livestock insurance (IBLI) be a ‘third way’ out of the pastoralist paradox by reducing uninsured, drought-related risk? In this paper, we aim to answer these questions using a discrete choice experiment embedded in a unique large-scale survey directed at pastoralists in four counties in Kenya. As highlighted in Banerjee and Duflo (2011), the poor are no less rational than anyone else. Precisely because they have so little, they are often found to be putting much careful thought into their choices. It is these choices that this paper attempts to unravel.

The remainder of this paper is organized as follows: section 2 introduces the four study counties in Kenya, and the livestock insurance system used as an attribute in the analysis. In section 3, we present the data and in section 4 we introduce the econometric strategy. We present and interpret our results in section 5 and discuss the main conclusions that can be drawn from the study in section 6.

2. Study area

This study focuses on the Kenyan rangelands that cover slightly over 82 per cent of the country and are home to millions of pastoralists and agropastoralists practicing mainly small-scale livestock keeping. The four Kenyan counties chosen as case study areas, West Pokot, Baringo, Laikipia and Isiolo (see figure 1), are all dominated by semi-arid land, where pastoralism and agropastoralism are the main forms of livelihood. Within and in a comparison between the counties, the transition towards more sedentary, privatized, and commercialized agropastoralism land use practices are in different phases and has taken different forms, as reported below. It is not known how many Kenyans currently hold land under community/customary tenure, since no county government has yet investigated this, although required to do so by the Community Land Act of 2016.

2.1 West Pokot County

In West Pokot County, pastoralism in the form of agropastoralism and nomadic pastoralism supports over 90 per cent of the county’s population (Muricho *et al.*, 2019). West Pokot borders Baringo County to the east and the studied wards, Suam, Chepareria and Riwo, all lie in the southwestern part of the county. Kenya has a bimodal type of rainfall and the long rains fall between April and August while the short rains fall between October and February. Based on the 2009 census, the urban population accounted for only 8 per cent of the total population in the county, making West Pokot one of the least

¹ However, in the survey reported in this paper we used the, for the pastoralists, more familiar term ‘group ranch’ to denote community land.

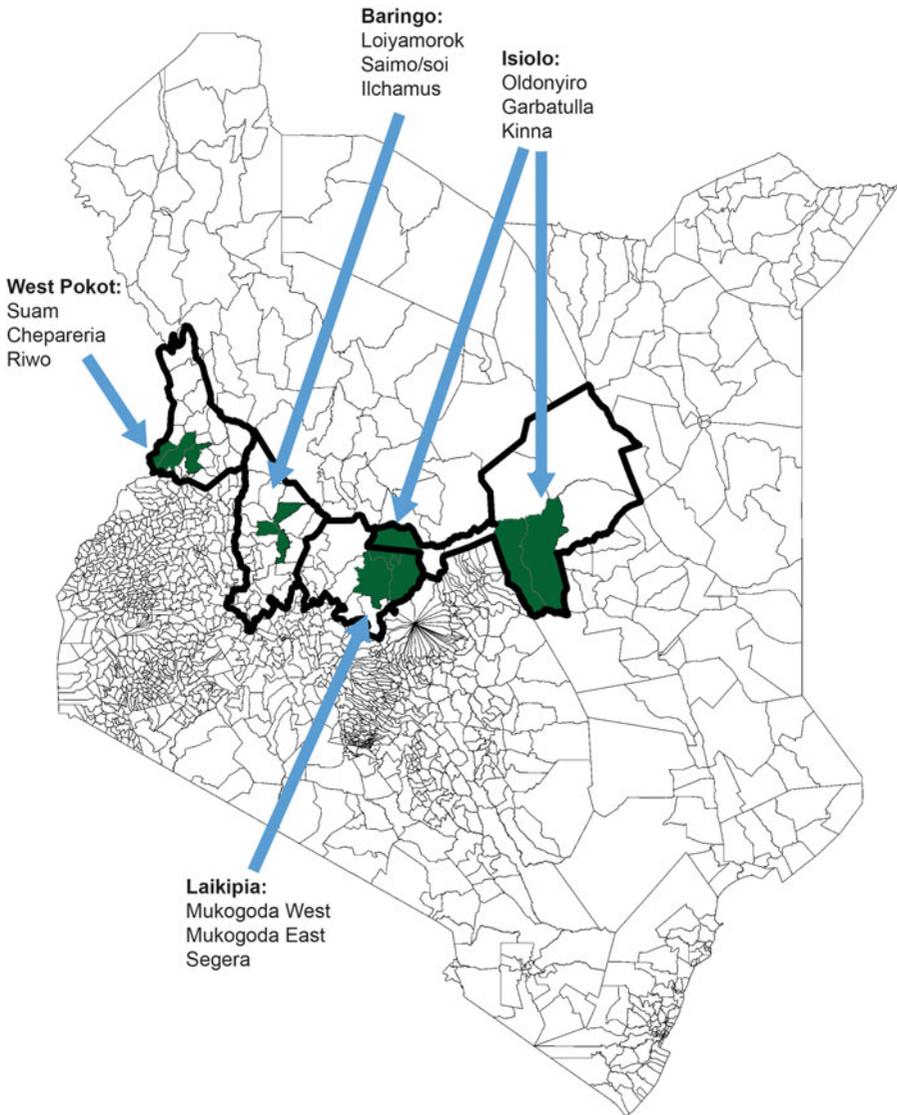


Figure 1. Locations of counties (in bold) and wards in the study.

urbanized counties in Kenya (Government of Kenya, 2012). Sixty-nine per cent of the population live below the poverty line (MoALF, 2016).

In terms of variation within the West Pokot wards included in the empirical study, Chepareria ward has seen extensive implementation of rangeland enclosures for boundary demarcation, to alleviate pasture scarcity and enable proper management of formerly degraded areas. This process has been thoroughly described in the literature (e.g., Nyberg *et al.*, 2015; Wairore *et al.*, 2015a, 2015b, 2015c). In the data set reported in this study, West Pokot is also the county with the lowest share of pastoralists with neither private

nor group title deed. West Pokot is also the county with the highest share using active fodder management as a coping strategy, suggesting a transition to agropastoralist land use practices.

2.2 Baringo

Baringo County is situated in the Rift Valley region and shares borders with eight counties, including West Pokot to the northwest and Laikipia to the east. The studied wards – Ilchamus, SaimoSoi and Loiyamorok – all lie in the center of the county. As in West Pokot, the majority of the population (90 per cent) reside in rural areas (MoALF, 2017a). The poverty level in the county is relatively high (58.5 per cent) (MoALF, 2017a). According to Vehrs (2016), among the East Pokot north of Lake Baringo – which the study ward of Loiyamorok is part of – livestock numbers per km² have increased tremendously during the twentieth century. In the data set reported in this study, no one in Baringo had private title deed, and the majority had no title deed at all. Active fodder management was mainly practiced in the Ilchamus ward, which benefits most from the abundant source of fresh water provided by Lake Baringo, one of the few freshwater lakes in the Rift Valley floor.

2.3 Laikipia

The County of Laikipia encompasses a vast highland plateau west of Mount Kenya. The county has a dramatic history, which includes forced resettlement of Maasai from the Laikipia plateau to areas close to the Kenyan border with Tanzania (Hughes, 2006). Current land use and tenure arrangements have been shaped by this history, and today as much as 40 per cent of the county is owned by a small minority of the population, divided among 48 large-scale properties (Letai, 2011). Thus, competition for land has been high for decades, and many of the pastoralists are confined to group ranches, mainly in Mukogodo West and Mukogodo East wards, surrounded by large privately-owned estates. One effect of this is that livestock are now more or less stationary, where pastoralists previously moved seasonally in accordance with grazing conditions (Huhó *et al.*, 2010; Boles *et al.*, 2019). Another effect is conflicts between pastoralists and the owners of these estates (cf. Bond, 2014).

2.4 Isiolo

The final county included in the empirical study is Isiolo. This county has a strange shape, with a ‘panhandle’ shaped region in the west, comprising Isiolo town and Oldonyiro ward (directly north of Laikipia). The main body of the county lies east of this panhandle where the study wards of Garbatulla and Kinna are located. Most of the land in Isiolo County is a flat, dry low-lying plain. For agricultural and livestock grazing, the British colonial government classified most of present day Isiolo County as ‘low potential’. This meant the push towards privatization of land has been low, and today more than 80 per cent of the land in Isiolo is communally owned and is under the trusteeship of the county government (MoALF, 2017b). Less than 10 per cent of the land is under private ownership with more than 80 per cent of the land being used as grazing land by pastoralists. In the data set reported in this study, the vast majority of the respondents had no title deed.

The overall picture suggests a rough gradient from west to east, but with many exceptions. The westernmost counties of West Pokot and Baringo (at least certain wards) have

come furthest in the transition towards more sedentary, privatized and commercialized agropastoralism, while parts of Laikipia represents a more 'organized' form of traditional pastoralism with community title deeds. Isiolo represents traditional pastoralism with less secure land rights. Isiolo is also the county where the process of land adjudication is most delayed.

2.5 Livestock insurance in Kenya

Index-based livestock insurance or IBLI has received widespread attention in development research as a way of reducing uninsured, drought related risk – especially among poor pastoralists who lack access to commercial insurance products. With IBLI, the insured party makes annual premium payments and receives indemnity payments based on realizations of some objectively measured climate index variable relative to some predetermined threshold (Chantarat *et al.*, 2017). One advantage with IBLI over traditional insurance is that payments are not triggered by individual claims, but by the value of the climate variable. This has the potential to both reduce transaction costs and minimize problems with adverse selection and moral hazards. However, one disadvantage is that IBLI may either overpredict or underpredict actual losses for an individual pastoralist. Overprediction occurs if actual drought losses are smaller, or nonexistent, compared to the predictions of the climate index. Conversely, underprediction occurs if the contract holder experiences a loss even though no indemnity payments are triggered by the index. This imperfect correlation is referred to as 'basis risk' (Chantarat *et al.*, 2017). A study based on data on IBLI in Marsabit County showed that policyholders are left with an average of 69 per cent of their original risk due to high loss events (Jensen *et al.*, 2016), showing that IBLI is no panacea.

The Government of Kenya launched an IBLI program in 2014 in collaboration with the World Bank called the Kenya Livestock Insurance Program (KLIP). KLIP is run by the Ministry of Agriculture, Livestock, and Fisheries (MoALF), and is supported by the International Livestock Research Institute (ILRI), the World Bank, and the commercial insurance company Swiss Re. ILRI is currently the calculating agent that does the index and payout calculations. KLIP utilizes the Normalized Difference Vegetation Index (NDVI), often referred to as 'greenness maps', assessments from satellite remote sensing to determine the level of drought (Miller *et al.*, 2020). The insurance triggers, which determine whether payouts should be made, are identified by the response of observed NDVI values. These insurance payouts allow pastoralists to purchase food and water to sustain or replace lost livestock. Focusing on our four study counties, KLIP covered Isiolo, West Pokot, northern Baringo and northern Laikipia at the time of the study (Miller *et al.*, 2020), but only in Isiolo and Laikipia had more than a few respondents joined.

3. Data

In the present paper, we use a discrete choice experiment (DCE) to explore how Kenyan pastoralists trade off between tenure security and tenure flexibility under climate uncertainty. The DCE is part of a unique survey of pastoralists in Kenya targeting 12 wards in the counties of West Pokot, Baringo, Laikipia, and Isiolo. In the DCE, pastoralists were asked to choose between two experimentally-designed tenure regimes and the status quo, which implied staying with the current tenure regime. Each tenure regime was

described by four attributes: (1) Type of tenure regime, (2) distance to emergency grazing grounds, (3) availability of livestock insurance, and (4) cost of tenure registration and land surveying.

3.1 Attributes

The attributes were selected based on a review of the literature, discussions with local experts and project partners, and testing in focus groups in the different counties. Concerning attribute (1), the Kenyan constitution allows for three different types of land tenure: private land, community land and public land (Government of Kenya, 2016). Each alternative is defined by one of these tenure regimes where one would always be private tenure and one would always be group tenure. In case of extreme drought, it is important to have access to emergency grazing areas, which motivates attribute (2). However, land fragmentation resulting from, for example, land privatization, can make the migration distance to alternative grazing areas longer, and herein lies the pastoralist's paradox (Turner *et al.*, 2016). Livestock insurance in the form of KLIP can in a way be an alternative to migration, which motivates attribute (3). The KLIP-program allows a pastoralist to insure up to 14 animals against drought for about 1,200 Kenya Shillings (KES) per animal and year. As mentioned, the payouts are pegged to satellite measurements of forage conditions (Miller *et al.*, 2020). Plans are to introduce KLIP throughout Kenya; however, there is a latent risk that the program will be discontinued because of its high cost. All attribute levels are the same except for the distance to alternative grazing grounds. Given different degrees of land fragmentation in the different counties, this might differ substantially. We show an overview of attributes and levels in table A1 in the online appendix.

3.2 Design

The attributes and levels were combined into choice tasks using an efficient experimental design where efficiency was determined based on minimizing the d-error of the design. The design was created using NGENE (Choice Metrics, 2021). We assumed a linear-in-the-parameters utility specification where the different land tenure regimes entered as indicator variables subject to the constraint that there could only be one land tenure regime in each alternative. In practice, this becomes a labelled experiment where the order of the labels varies between choice tasks. The availability of the insurance program was also included as an indicator variable. Migration distance in case of drought and cost entered linearly.

The initial design was a d-efficient design with zero priors based on the multinomial logit (MNL) model. Each design consisted of 24 choice tasks blocked into four sets of six choice tasks and respondents were randomly allocated to a block. The design was blocked to limit the number of choice tasks faced by each respondent to avoid respondent fatigue. The initial design was used as part of a pilot study to obtain better, i.e., non-zero, priors to use in an updated design. We used small fixed non-zero priors, i.e., non-Bayesian, for all attributes except for the tenure regimes, where we retained the zero-prior assumption. Given that these attribute levels cannot be separately identified from the alternative specific constants, we decided to err on the side of caution by assuming a zero prior. More precise priors lead to a more efficient design, meaning that we can obtain more precise estimates with smaller sample sizes, i.e., smaller standard errors (Scarpa and Rose, 2008). This was particularly important in our application because overall sample sizes were likely to be on the small side. All designs were optimized separately for each county

with county-specific priors both because the levels of the distance to alternative grazing grounds attribute differed between counties, and because the difference in land tenure regimes between counties may mean that preferences differ.

3.3 Implementation

Data was collected at the household level using a semi-structured questionnaire that was administered through a face-to-face interview by trained local enumerators and encoded on tablets. The recruited enumerators – four for each county – were university students from the University of Nairobi with fluency in the local languages. The main survey was conducted following extensive testing, with one focus group meeting per study county in November 2018. The number of participants in each focus group varied between 15 and 20 persons. The focus group meetings were organized as outdoor, roundtable-type meetings, where each question was discussed openly. This was followed by revisions to the survey, and a pilot study in April/May 2019, covering 122 respondents, evenly distributed in all study counties. The main purpose of the pilot survey was to test the attributes and levels in the DCE section and obtain priors to use when updating the design to increase its efficiency prior to the implementing the main survey.

The DCE was part of larger survey about land tenure rights and climate change. The DCE part of the survey began with an introductory text and descriptions of the attributes and levels. We included a standard ‘cheap talk’ script with a budget and opt-out reminder. A translated version of the text can be seen in its entirety in the online appendix, together with an example of a choice set. Our enumerators were trained to present all the information in the introductory script to respondents and instruct them in how to understand and answer the choice tasks. No practice choice task was included in the survey. Respondents were randomly allocated to either a low or high climate variability treatment. In the low treatment, respondents were told that the drought frequency would remain as today with one drought every five years, on average, while respondents in the high variability treatment were told that they could expect two droughts every five years. As such, our design allows us to explore pastoralists’ preferences along two dimensions: (i) climate variability and (ii) tenure flexibility.

Systematic multi-stage cluster sampling was used to select the individual household respondent from selected villages in each ward. In the first stage, sampling was purposive to West Pokot, Baringo, Laikipia and Isiolo because of the different land use changes occurring in the four counties. A multi-stage sampling approach was used in the second stage. Within the four counties, three wards per county were purposively selected considering the different land uses within the counties, conditional on there being a largely pastoralist community living in the ward. These were the primary sampling units for the survey, making a total of 12 sampling units. Within each sampling unit we used a systematic random sampling approach. The data was gathered in March and April of 2020 in the counties of Baringo, Isiolo, Laikipia and West Pokot in Kenya. A total of 520 respondents were interviewed across the four counties, resulting in 485 usable² responses. The distribution across the counties was even, with 124 respondents from West Pokot, 120 from Baringo, 120 from Laikipia, and 121 from Isiolo.

²Usable in the sense that the questions focused on in this paper were answered.

3.4 Sample summary

In table 1, we show sample summary statistics along the dimensions used in the design for each ward in the study. We see that in Baringo and Isiolo, people primarily use public land and few have title deeds. The exception is Saimo/soi ward in Baringo, where more than half of the respondents have group title deeds. In the Laikipia and West Pokot wards, group title deeds appear to dominate. We find the highest degree of private land in West Pokot. The exceptions are Segera wards in Laikipia County and Suam ward in West Pokot, where none of the respondents had a title deed. Although most respondents do not currently have livestock insurance, the highest level of adoption can be found in the Isiolo wards. In Isiolo the adoption of livestock insurance is particularly strong in Oldonyiro ward, in the westernmost part of the county. Oldonyiro borders Mukogodo East in Laikipia County, where the adoption of insurance is also relatively high. The impression is that information about the possibility of purchasing index-based livestock insurance is something that has grown organically, partially through word-of-mouth, from east to west across the study region.

Average distance to alternative grazing grounds in case of a drought vary markedly between the wards, with a notably low distance found in Ilchamus ward. The explanation lies in the fact that Ilchamus is directly south of Lake Baringo, one of the largest freshwater lakes in the Rift Valley, and an abundant source of fresh water in drought situations. Except for Laikipia, the average distances are right where we expect them to be relative to our design and the pilot survey.

Across the wards, the surveyed heads of households are predominantly male, with an average age ranging from 36 to 57 years old. Education levels are relatively low, with average years of schooling being less than 10 years. While we do not know respondents herd sizes, we do know their self-reported income from various sources. With this, we created a variable for income share from livestock, which captures the importance of livestock to a respondent's livelihood. This also differs markedly between wards. Table A2 in the online appendix shows the p -values of the pairwise tests for significant differences between the counties. For the continuous variables, we used pairwise t -tests and for the categorical variables we used non-parametric χ^2 tests. With few exceptions, all differences between counties are significant.

Unfortunately, the data gathering in West Pokot County was affected by the outbreak of Covid-19. Our enumerators did the best they could with pen-and-paper and motorcycles to gather the data, only to later fill it into the survey instrument. Upon inspection of the data, the quality was poor,³ and we were forced to exclude all data points from West Pokot in the choice analysis.

4. Empirical approach

To introduce notation, let respondent n 's utility from choosing alternative i in choice situation s be described by the linear-in-the-parameters random utility function:

$$U_{nis} = \beta X_{nis} + \varepsilon_{nis}, \quad (1)$$

³For the choice experiment part of the survey, the choices appear completely random with an almost perfect split between the two experimentally-designed alternatives and almost no choices for the status quo (see table A3 in the online appendix) which makes estimation of choice models very hard and yields counter-intuitive signs for the cost parameter.

Table 1. Summary statistics based on self-reported data along the levels of the attributes

County	Ward	No title deed (%)	Group title deed (%)	Private title deed (%)	Insurance (%)	Distance (drought, km)
Isiolo	Garbatulla	100.00	0.00	0.00	2.00	31.9
Isiolo	Kinna	94.87	0.00	5.13	7.69	85.5
Isiolo	Oldonyiro	87.50	0.00	12.50	21.88	31.5
Laikipia	Mukogodo East	17.50	80.00	2.50	12.50	58.1
Laikipia	Mukogodo West	25.00	65.00	10.00	2.50	69.9
Laikipia	Segera	100.00	0.00	0.00	2.50	6.4
Baringo	Saimo/soi	46.43	53.57	0.00	0.00	43.0
Baringo	Ilchamus	100.00	0.00	0.00	0.00	14.0
Baringo	Loiyamorok	97.50	2.50	0.00	0.00	63.1
West Pokot	Suam	100.00	0.00	0.00	0.00	82.2
West Pokot	Chepareria	4.76	71.43	23.81	1.59	50.7
West Pokot	Riwo	0.00	96.77	3.23	3.23	64.1
County	Ward	Male (share)	Age	Years of education	Income share from livestock ^a	N
Isiolo	Garbatulla	0.50	44.3	9.50	0.78	50
Isiolo	Kinna	0.63	38.7	7.71	0.61	39
Isiolo	Oldonyiro	0.68	35.9	7.71	0.69	32
Laikipia	Mukogodo East	0.43	38.1	8.38	0.66	40
Laikipia	Mukogodo West	0.53	38.5	7.75	0.57	40
Laikipia	Segera	0.63	40.8	6.58	0.53	40
Baringo	Saimo/soi	0.82	48.7	9.29	0.63	28
Baringo	Ilchamus	0.87	57.0	5.33	0.35	52
Baringo	Loiyamorok	0.69	49.6	6.13	0.74	40
West Pokot	Suam	0.63	41.6	4.93	0.56	30
West Pokot	Chepareria	0.92	44.3	7.21	0.45	63
West Pokot	Riwo	0.81	47.4	7.84	0.66	31

^aUnavailable for 35 respondents in Baringo and 22 respondents in Isiolo.

where β is a vector of parameters to be estimated, x_{nis} denotes the levels of the attributes and ε_{nis} is a Type 1 Extreme Value distributed error term. Under these standard assumptions, the probability that respondent n chooses alternative i in choice situation s can be expressed by the MNL model (McFadden, 1974; Ben-Akiva and Lerman, 1985):

$$Pr(i_s | X_{nis}, C_n) = \frac{\exp(\sigma_i \beta X_{nis})}{\sum_{j \in C_n} \exp(\sigma_j \beta X_{njs})}, \tag{2}$$

where C_n is the set of considered alternatives and σ_i is a scale parameter that is inversely related to the variance of the error term. The MNL model is the workhorse in discrete

choice analysis, but its usefulness is limited because it does not consider that respondents made a sequence of choices nor does it allow us to describe unobserved preference heterogeneity. We can overcome these limitations by using a more flexible model structure. The latent class (LC) model allows us to capture unobserved preference heterogeneity and take the panel structure of the data into account (Greene and Hensher, 2003; Train, 2009). Let π_q be the probability that respondents' preferences can be described by the q th vector (class):

$$\pi_q = \frac{\exp(\alpha_q + \gamma_q Z_n)}{\sum_{q=1}^Q \exp(\alpha_q + \gamma_q Z_n)}, \tag{3}$$

where α_q is a class specific constant, γ_q a vector of parameters to be estimated, and Z_n a vector of respondent specific variables. We set the Q^{th} parameter vector and constant to zero for identification. We can express the overall choice probability as the weighted sum of within-class choice probabilities as follows:

$$Pr(y_n | X_{nis}, C_n, \pi) = \sum_{q=1}^Q \pi_q \prod_{s=1}^S \frac{\exp(\sigma_i \beta_q X_{njs})}{\sum_{j \in C_n} \exp(\sigma_i \beta_q X_{njs})}. \tag{4}$$

Notice that we are now taking the panel structure of the data into account by taking the product over the sequence of choices made by respondent n . Given our linear-in-the-parameters utility specification (equation (1)), (unconditional) willingness-to-pay is simply the negative ratio of the non-cost parameters to the cost parameter. In a latent class model, the sample level willingness-to-pay (WTP) is the weighted sum of the within-class WTPs, where the weights are the unconditional class probabilities. To account for relative differences in error variance (Swait and Louviere, 1993) between the different counties and our climate treatments, we estimate relative scale parameters of the form:

$$\sigma_i = \frac{\sum_{k=1}^K \theta_k I_{ki}}{\theta_1} \tag{5}$$

where θ_k is a relative scale parameter, I_i an indicator for whether respondent i is in group k , and θ_1 is fixed to unity. This secures that scale parameters can be interpreted directly.

In this data, not all respondents consider all alternatives. Some respondents always chose the status quo, sometimes chose the status quo or never chose the status quo, with the first and last groups dominating across all regions (see results section). One way to capture this behavior is by using an independent availability logit model, or IAL (Manski, 1977). An IAL model is similar to a latent class model in that it probabilistically puts respondents into different classes, however, in an IAL model, the classes are defined on the basis of which alternatives are in the consideration set and not preferences. A failure to capture respondents' actual consideration set may lead to bias, especially in the choice probabilities, because the probability of the chosen alternative is calculated on the basis of all alternatives being considered. For example, if a respondent considers only a subset of the alternatives, we will underpredict the probabilities of choice and this may affect the estimated parameters. Therefore, if respondents have not considered, for example, the status quo, because 'anything is better', then our model should capture this. This is not the same as modeling a pure status quo (SQ) bias, because a respondent can still never choose the SQ and still consider it at the same time. The model attempts to separate this behavior from the behavior of respondents that never chose the SQ and at the same time

did not even consider it. If we let the class probability be described by equation (3), then we can write the likelihood function of the IAL model as follows:

$$Pr(y_n|X_{nis} C_n, \pi) = \sum_{q=1}^Q \pi_q \prod_{s=1}^S \frac{\exp(\beta X_{niss})}{\sum_{j \in C_{nq}} \exp(\beta X_{njs})} \tag{6}$$

and

$$C_n = \begin{cases} q = 1 \rightarrow \{1, 2, SQ\} \\ q = 2 \rightarrow \{1, 2\} \\ q = 3 \rightarrow \{SQ\} \end{cases} \tag{7}$$

for the full model. All models are estimated using the statistical programming language R (R Core Team, 2020). To reduce the likelihood of the LC model converging to a local optimum, we used the following procedure to search for better starting values: (1) Generate 10,000 vectors of random starting values, (2) evaluate the log-likelihood function at each set of starting values, (3) sort based on the log-likelihood value, and (4) estimate the best fitting model to completion. We repeated steps (1–4) 50 times and chose the best fitting model.

5. Results

We show the results of our chosen models in table 2.⁴ The results from the MNL model show that pastoralists have a negative but insignificant disutility of cost, i.e., positive marginal utility of money, and that they dislike increased distance to emergency grazing grounds and place a positive value on the availability of insurance. Interestingly, we see that people seemingly have negative preferences for private title deeds and positive utility for group title deeds, relative to their current situation. However, these estimates are relative to their current situation, which varies considerably. Given the restrictions in the design that if one alternative had a private title deed, the other needed to have a group title deed, these parameters are not separately identified from the alternative specific constants and since only J-1 constants are identified, we cannot estimate a separate constant for the SQ alternative.

Looking at the relative scale parameters, we see that respondents in Laikipia have a relatively more deterministic choice process as seen from the econometricians’ point of view, compared to Baringo County. Isiolo on the other hand appears to have slightly more stochastic choices as evidenced by a smaller relative scale parameter. There appears to be no significant difference in unobserved effects between respondents in the low and high climate variability treatments, as evidenced by the insignificant relative scale parameter. A log-likelihood ratio test shows no difference in the observable part of the utility function between models run on the subset of respondents in the low and high climate treatments.

To try to understand what drives the counter-intuitive signs in the MNL model for tenure regime, we take a closer look at the share of respondents who always, never, and

⁴During our model search, we ran separate models on each subset of the data to test for preference and scale differences. We ran multiple LC and IAL models with up to four classes. Final models were selected based on a combination of model fit and intuitiveness of the results. In particular, moving beyond two classes led to convergence issues with very large parameter estimates and an inability to obtain standard errors. We also tested mixed logit models, but these fit the data only marginally better and were harder to interpret given the data limitations.

Table 2. Results from the multinomial logit (MNL), latent class (LC) and independent availability logit (IAL) models

	MNL		LC: Class 1		LC: Class 2		IAL	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Cost	-0.0070	0.0055	-0.0071	0.0033**	0.0262	0.0305	-0.0086	0.003***
Private	-0.0609	0.0556	2.0469	0.2505***	-1.0194	0.5653*	1.2074	0.200***
Group	0.0295	0.0523	2.0949	0.2541***	-0.8260	0.5062	1.2478	0.2052***
Flexibility	-0.0055	0.0017***	0.0001	0.0005	-0.0842	0.0154***	0.0002	0.0003
Insurance	0.3646	0.0751***	0.2029	0.0411***	0.0809	0.2441	0.1736	0.0357***
Class probability function								
Constant			-1.8119	0.4455***	0.000	(fixed)	-1.4502	0.4275***
Livestock income share			1.8755	0.3784***	0.000	(fixed)	1.6433	0.3713***
No title deed			0.3971	0.2875	0.000	(fixed)	0.3888	0.2836
High climate variability			0.4118	0.2668	0.000	(fixed)	0.3832	0.2642
Distance to grazing grounds			0.0102	0.0038***	0,000	(fixed)	0.0077	0.0035***

Continued.

Table 2. Continued

	MNL		LC: Class 1		LC: Class 2		IAL	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Average class probability								
Class 1 (IAL: All alts)			57.80%				59.65%	
Class 2 (IAL: Only SQ)			42.20%				40.35%	
Relative scale parameters								
Baringo	1.000	(fixed)	1.000	(fixed)			1.000	(fixed)
Isiolo	0.691	0.160*	6.386	1.416***			6.359	1.364***
Laikipia	3.509	0.883***	2.288	0.384***			3.558	0.706***
Climate high	1.120	0.173	0.816	0.092**			0.807	0.117*
Model statistics								
LL	−2175.417		−908.725				939.598	
BIC	4412.261		1951.129				1975.740	
K	9		20				15	
N^a	2161		1680				1680	

Notes: *, **, and *** indicate significance at the confidence levels of 10, 5, and 1%, respectively.

^aThe loss of choice observations is caused by missing data in the class probability functions, especially in the distance and income share variables.

sometimes chose the status quo. Table A3 in the online appendix shows that for Baringo County, as few as five per cent of respondents make tradeoffs with respect to the status quo in some wards (Loiyamorok), whereas in Ilchamus ward 23.08 per cent made this tradeoff. At the county level only 16.7 per cent of respondents made tradeoffs. Looking back at [table 1](#), this does not appear linked to whether or not respondents have a current title deed because in both wards the vast majority has no title deed. This choice pattern is even more pronounced for the other counties. The odd one out is West Pokot County where almost no one chose the status quo. This sharp distinction between respondents who always or never choose the status quo is not unheard of when using DCEs in developing countries (see, e.g., Xuan and Sandorf, 2020; Börger *et al.*, 2021). We return to possible reasons for why this happened, and provide some lessons learned and recommendations for future research in the discussion, but the lack of tradeoffs with respect to the status quo makes it a challenge to model and make correct inferences with respect to respondents' preferences.

As a first step to address the above, we estimate an LC model on the pooled data with income share from livestock, whether a respondent had no title deed, the climate variability treatment indicator and distance to alternative grazing grounds in the class probability function, and relative scale parameters for county and climate treatment. These variables are significantly different between the counties and between respondents who always and never chose the status quo (see the online appendix). We see that respondents in Class 1 have a negative and significant parameter for cost and positive and significant parameters for the non-cost attributes, as expected. Somewhat surprisingly, they weakly prefer group tenure rights to private tenure rights. This could perhaps be understood in the context of the fact that a proliferation of private tenure rights is associated with increasing fragmentation of the landscape with long migration routes to alternative grazing grounds in case of drought. Interestingly, the preferences for changes in distances to alternative grazing grounds is insignificant. On average, about 57.8 per cent of respondents are predicted to be in this class, and they are unlikely to choose the SQ. This unwillingness to choose the SQ is combined with the knowledge that most people either always or never chose the SQ (table A3 in the online appendix) which explains the very low sensitivity to cost.⁵

Respondents predicted to be in Class 2, on the other hand, have a positive and insignificant cost parameter and negative and significant parameters for the two land tenure regimes. They dislike private tenure regimes more than group tenure regimes and have a strong disutility for increased distance to alternative grazing grounds. On average, about 42.2 per cent of respondents are predicted to be in this class and they are likely to always choose the status quo.

From the class probability function, we see that people on average are unlikely to be in Class 1, but that a respondent's share of income from livestock is a strong explanatory variable. The higher the income share from livestock, the more likely the respondent is to be in a class with strong preferences for more secure tenure rights. While people with no title deed are more likely to be in this class, the effect is insignificant. Respondents in the high climate variability treatment are also more likely to be in Class 1, but again,

⁵ A reviewer suggested that this behavior could be the result of attribute non-attendance (see, e.g., Sandorf *et al.*, 2017). However, we believe it is more likely that never choosing, or even never considering, the zero cost status quo option, and always choosing alternatives with no tradeoff against zero, will manifest as a very low cost sensitivity that is driven not by ignoring the cost attribute, but by never considering the current situation.

this effect is insignificant. Interestingly, respondents with longer distance to alternative grazing grounds are more likely to be in this class. It can be as simple as those who already have a long distance do not have strong preferences since they know that they will not get shorter migration, while those who have short migration distances sort to Class 2 because they really want to keep these short distances. Indeed a strong disutility from increased migration is highly significant.

We do see changes in the relative scale parameters where respondents in Isiolo and Laikipia have a relatively more deterministic choice process as seen from the perspective of the econometrician compared to respondents in Baringo, and that people in the high climate variability treatment now have a significantly relatively more stochastic choice process.

In fact, it appears that our two-class model picks up the people that made tradeoffs and the ones that did not, and that our model is picking up this choice pattern more than differences in preferences. To confirm the results above, we ran an IAL model where we assume that respondents in Class 1 consider all alternatives and respondents in Class 2 only considered the status quo. First, we note that the preference pattern is similar to that described by Class 1, although with a marked downward shift in preferences for the two tenure regimes. While such a comparison is somewhat misleading given the different scale of the model, the implied WTP estimates from the IAL model are about 50 per cent smaller compared to those in Class 1. Looking at the class probability functions shows that a higher income share from livestock is associated with a higher probability of considering all alternatives, relative to only considering the status quo (stay with current tenure regime), and the same holds true for increasing distance to grazing grounds. This suggests that people who are highly dependent on livestock are more likely to fully consider all alternatives presented to them. The average class probabilities for being in Class 1 and 2 are comparable to those reported for the LC model, suggesting that indeed what Class 1 and 2 in the LC model is picking up is the difference in choice pattern in combination with differences in preferences.

Figure A1 in the online appendix shows the distribution of the estimated unconditional sample level WTP from the LC model for each attribute by climate variability treatment and current title deed. We note that the sample level WTP is very high and much higher than our bid-vector and the WTP derived from the IAL model. As argued above, the high WTP is likely caused by an apparent insensitivity to cost resulting from few tradeoffs with respect to the status quo (it was mostly either or). Therefore, it is our interpretation of the data and WTP that these are strong signals in favor of increased tenure security in Kenya, and does not necessarily represent underlying WTP. People consistently choosing an improved situation irrespective of the cost is a strong signal. This is likely triggered by either experienced or anticipated fear of land privatization, as well as inter- and intra-ethnic resource conflicts, in relation to institutional and economic processes of land fragmentation in the research area.

As expected, we see that WTP is increasing in the share of income from livestock.⁶ We see that across the income share distribution, respondents without a title deed in the high climate variability treatment have the highest WTP (strongest preferences for increased tenure security). The difference in WTP to obtain a group or private title deed is negligible, suggesting that stronger tenure rights are preferred to no tenure rights.

⁶Note that the trends are identical, and this simply reflects the fact that income share from livestock is included in the class probability function and therefore more weight is put on the WTP from Class 1 as income share increases.

Interestingly, the results suggests that respondents without a title deed who have a large share of their income from livestock have higher WTP compared to those with little to no income from livestock. This could possibly be strengthened if pastoralists with title deeds also tend to diversify, and by obtaining other sources of income become less nomadic.

It is also clear that respondents feel the necessity to take part in the privatization that is happening, and that obtaining a group or private title deed is a next step on the property ladder and a way to diversify their income source. Looking at income sources supports this, although item nonresponse on this question was high. The difference in median income from livestock keeping is small when comparing tenureless respondents with group ranch respondents, but a much larger share of group ranch respondents also have income from crops, 41.4 per cent, compared with 23.1 per cent. An even higher share of the respondents with title deeds have incomes from crops, 66.7 per cent, a clear indicator that property rights support the more sedentary source of income that crops constitute.

Mean WTP for increased flexibility, i.e., reduced distance to emergency grazing grounds, is negative, but very close to zero. This suggests that although the increased distance to alternative grazing grounds that privatization and fragmentation of the landscape could involve in future is a potential problem, it is not currently high on the pastoralist agenda in the region.

WTP for livestock insurance is positive, but much lower than for title deeds. The WTP can be compared with average premium rates paid by a KLIP-insured pastoralist, which are roughly 8.5 per cent of the value of the insured amount. This translates into an annual premium of about KES 1,200 for one cow, KES 120 for a goat or sheep and KES 1,750 for a camel. Estimated WTP ranges from KES 10,000 to 30,000, and is increasing in dependence on livestock as a source of income. This can be compared to the total cost of insuring 14 cows (the maximum under KLIP) of KES 14,400, which is at the lower end of the WTP.

Thus, the WTP range is enough to insure 8 to 25 cows. However, given that the WTP for many respondents is higher than the cost of insuring the maximum number of livestock, it is hard to explain the low level of participation in IBLI, which is low even in a county such as Isiolo where it has been offered since 2014.

Overall, we believe that the high WTP estimates, which are a direct result of few people considering the SQ, means that they are either happy to stick with their current situation, always choosing the SQ, or possibly dissatisfied with their situation, never choosing the SQ. This can be related to responses to Likert-scale questions in the survey about the extent to which the respondents worry about tenure security, access to grazing land and climate change, respectively. In the responses we see that respondents worry a lot about the future, and most of all about climate change.

6. Discussion and conclusions

The focus in this paper has been on the pastoralist paradox – how do pastoralists evaluate the tradeoff between the need for tenure security and flexibility regarding the use of grazing grounds? Is the trend towards more individual property rights a viable route, even if it involves a fragmented and privatized landscape with long migration routes to alternative grazing grounds in case of drought? In addition, what about the increased popularity of IBLI? Could it be a ‘third way’ out of the pastoralist paradox by reducing uninsured, drought-related risk?

We address these questions using a DCE with attributes targeting tenure security, access to alternative grazing grounds and livestock insurance. Since the choice experiment technique focuses on tradeoffs among scenarios with different attributes, it is especially suited to model policy decisions where a set of possible actions might result in different impacts on natural resources or tenure security. The results from this unique survey dataset, which covers four interconnected counties in the semi-arid regions of north-central Kenya, show that the answer to these questions depends on the personal experiences of individual pastoralists. These experiences vary greatly as pastoralist life is very different across counties and wards. Overall, the preference for the status quo was strong in most counties. This can be a reflection of general risk aversion towards changes in livelihood conditions if the current situation is deemed acceptable.

Nevertheless, of course, ultimately preferences must be evaluated on an individual rather than a county or ward basis. As the LC estimates reveal, there is one group of respondents who are desperate for change and seem to prefer either a group or private title deed to their current situation. The apparent indifference between the two may be a reflection of a preference for the arguably larger flexibility when it comes to alternative grazing provided by a group ranch membership, or if these respondents simply consider it more realistic to join an existing group ranch than to obtain a private title deed, is hard to tell from this data. By contrast, the second, smaller, LC group has strong preference for the status quo, which could be driven by their relatively short migration distances.

The movement towards private land is reflected in the ongoing fragmentation and informal individualization of group ranches held under collective title in West Pokot, Baringo and Laikipia (e.g., Nyberg *et al.*, 2015; Vehrs, 2016; German *et al.*, 2017). This raises the question of whether group ranches and collective titles ultimately are sustainable long-term solutions to the pastoralist's paradox. If the tenureless desire group ranch membership, but group ranch members through enclosures and exlosures demonstrate their desire for private title deeds, then in the long run the group ranch is just a transitory tenure arrangement. Ultimately, the preferences mentioned above are driven by an underlying sedentarization of the Kenyan pastoralist communities, partly enabled through livelihood diversification through, for example, farming and wage labor (cf. Bostedt *et al.*, 2020).

Concerning the third way to handle fragmentation, climate change, and the associated risk of livestock loss – livestock insurance – the evidence is mixed. The remaining basis risk suffered by the insured pastoralists due to underprediction is high, but nevertheless the WTP for livestock insurance should be high enough to ensure maximum uptake relative to prevailing insurance premiums. So why has the insurance uptake been so limited in the study area? Novelty could be one explanation, but the prediction accuracy of IBLIs also needs to be increased for insurance to be a genuine alternative.

Climate is changing in the study area, and the pastoralists are certainly not oblivious to this fact, as illustrated by the responses to the worry question. However, currently the most dramatic effects observed are increased high intensity rainfall with associated floods that contribute to soil erosion. Mean temperatures have increased only moderately. For this reason, the statement in the alternative climate treatment in the choice experiment that stated that 'drought frequency will DOUBLE in the future compared with today with an average of 2 droughts per 5 years' might not have been deemed credible by many respondents. Climate change is certainly a huge problem, but the small differences between the climate treatments in the choice experiment suggest that it does not seem to be high on the pastoralist agenda. An alternative explanation is that the

respondents feel that they already are experiencing the 'high' climate treatment. The climate treatments were based on IPCC scenarios for this region of Kenya, but given that climate change in many regions of the world moves faster than predictions, the low climate treatment could be seen by respondents as unrealistic. In fact, the study region has experienced three drought situations in the last seven years, which is closer to the high climate treatment than the low.

Gathering data in a developing country in a rural setting comes with its own set of challenges. While exploring the data and testing model specifications, it became obvious that despite our best efforts there are some issues with the data that complicate estimation and limit our ability to make statistical inference. As discussed, very few respondents made choices that included all three alternatives but chose either only the status quo or one of the experimentally-designed alternatives. This happened despite extensive pre-testing in focus groups and a pilot study where we did not observe the same strong patterns. This is not entirely unheard of in the context of developing countries and Börger *et al.* (2021) observe the same thing in their study in Vietnam. Problematically, the lack of tradeoffs does not provide us with any information about tradeoffs with respect to the current situation and is perhaps the main cause of our high WTP estimates. What is more interesting is why this happened and what we as practitioners can learn from this going forward. While contemporary guides for practitioners exist (Johnston *et al.*, 2017), they do not explicitly deal with the challenges connected with conducting stated preference research in developing countries. It is possible that the choice pattern we observe is a village-specific effect. Breaking the data down at the village level reveals almost no variation within villages where everyone in a village either always chose the status quo or never did. Another possibility is that it reflects an interviewer effect where the emphasis placed on the existence of the status quo, i.e., the possibility of sticking with their current situation, differed between interviewers. However, all interviewers were trained prior to going into the field and, given that there is a very strong correlation between the village and interviewer effect here, we cannot disentangle the two. A third possibility, which we observed in the pilot study, is social pressure during the interview process. In some villages during the pilot study, the village chief was in the room when the interview was conducted. While enumerators were instructed to ensure that interviews were conducted in private and confidential, we cannot exclude the possibility that social pressure played a role. This type of effect would also coincide perfectly with the village effect discussed above. Finally, it could be that respondents are not actually making tradeoffs, but are simply choosing the SQ/non-SQ alternatives to indicate that they do not, or do, want change. This would also explain the very clean result that most people either always or never chose the SQ. Regardless of why we observe this, the outcome for estimation is clear. Without sufficient tradeoffs being made, estimating discrete choice models becomes very difficult and allowing for unobserved heterogeneity is close to impossible. As our results showed, what we ended up picking up was the effect of always or never choosing the SQ.

There are a few other limitations of the study that can be useful for other researchers to learn from. In the questionnaire, we could have considered a broader set of climate scenarios, and could have incorporated questions about self-perceived effects of climate change, and self-reported data on drought occurrence. We could also have included questions that would enable us to attempt to classify the pastoralists, for example to identify agropastoralists. The use of enclosures could for instance have been used as an

indicator. However, any strict classification is susceptible to criticism, since the transition to more sedentary agropastoralism is a gradual process from a purely transhumant pastoralism to a more agropastoral, enclosure-dominated lifestyle that still has its economic base in livestock. Another limitation is that we could have included questions that would enable us to obtain a proxy for livestock herd size – although this is hard, based on experience with research on other pastoralist communities. Pastoralists are generally very reluctant to reveal their herd size.

Furthermore, in the spring of 2020, several counties in Kenya were affected by a large-scale locust invasion. Although we would expect that this could make respondents value tenure flexibility more than tenure security, with an increased preference for commons and community land as opposed to private title deeds, this is not the case. However, we are cognizant that we lack a proper counterfactual, i.e., counties that are similar but unaffected by the locust invasion. A second possible effect of the locust invasion is that respondents would place more emphasis on whether livestock insurance is available. Again, this does not seem to be the case. We do not have sufficient variation in the data or sampled counties to test for the effect of the locust invasion but are aware that this might affect the elicited estimates.

The 2010 Constitution of Kenya devolved governance to counties, which are currently making numerous local policies that need to be guided by science-based knowledge. This study adds to this knowledge and shows that land tenure arrangements are not merely functional ‘rules of the game’, but are dynamic, and subject change, driven by the preferences of the actors (cf. Leach *et al.*, 1999; Lesorogol, 2003). Future policy solutions, when it comes to pastoralist tenure systems, must safeguard livestock migration routes and ensure flexibility, while at the same time responding to the desire for private land driven by the sedentarization of the pastoralist communities. Ideally, an alternative tenure system should also score high in terms of pastoral production and cost efficiency, involve low transaction costs, and be transparent and politically acceptable.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/S1355770X22000298>

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