Watchman Field Experiment – Pre Analysis Plan

Julian Dyer

May 22, 2018

Abstract

This document describes the analysis plan for a field experiment in crime and property security in rural Kenya. I create randomised variation in farm security by matching randomly selected Kenyan smallholding farmers with subsidized Maasai watchmen to protect farms during the main agricultural season. I explore the effect of theft and property crime by testing whether farmers engage in different types of production when their farms are more secure against theft. I further explore how social networks are used to substitute for imperfect protection of property in an environment where state institutions are unable to fully protect farms, and how theft is used to sanction those who neglect social obligations. Finally, I test whether improved security and reduced fear of crime decrease the degree of ethnic ingroup-outgroup parochialism and political preference for authoritarian, 'strongman' leaders.

Keywords: theft, crime, institutions, agriculture

Contents

1 Introduction

This paper studies the consequences of theft from farms in central Kenya, where smallholding farming is the primary economic activity and where formal institutions imperfectly protects property rights. In this context, farm theft is a pervasive form of property crime that can distort production decisions away from high-risk crops towards less easily stolen staples. In addition, the risk of theft incentivises the formation of strong ingroup relationships to ensure mutual protection of farms and as a consequence of perceptions that 'others' are responsible for theft. This is also a context where public provision of property rights can readily be replaced by private protections, allowing households to avoid relying on public institutions. It is, however, difficult to identify causal mechanisms from observational data, as culture, institutional quality and production decisions are determined simultaneously. To understand how theft influences social outcomes and production decisions, I conduct a novel randomised experiment in protection against property crime. I randomly assign high-quality private protection of farms through an intervention facilitating the hiring of highly trusted Maasai watchmen, by matching households with watchmen and through targeted subsidies for wages and up-front payment of travel costs.

2 Intervention

The intervention in this project is matching farming households to high-quality, trusted Maasai watchmen at a heavily subsidized rate. The intention of this intervention is to cause variation in the security of farms during the August-December planting season. Watchmen are recruited with the assistance of partners from the Maasai Education Research and Conservation Centre (MERC) in Maasailand in January and early February. After information sessions with farmers and the collection of supplementary baseline information, farmers will be informed of their treatment status by the field coordinator at the end of May, giving them time to adjust planting decisions and input purchases. After being informed of their treatment status and given the contact information of the watchman they have been matched to, I schedule times for farmers to be expect a phone call from a watchman, so they can arrange the time of employment and other details. The wage rate paid by farmers and the subsidy are set in advance, so the treatment is uniform across the sample. The duration of the treatment is also set at a constant six weeks of watchman employment, at a time set by farmers to coincide with when they anticipate their crops

will be at risk.

3 Research Questions

My main research question is:

i. Does perceived insecurity constrain the type of economic activities farmers engage in? Does an intervention to improve farm security cause farmers to invest more in theft-risky production?

My secondary research questions are:

i. Does an intervention to improve private protection of property influence the shape of social networks? Are smaller, deeper networks a way of substituting for imperfect property protection? Does an intervention to improve property protection cause people to form broader, more shallow networks?

ii. Does an intervention improving private protection of property cause substitution away from public institutions charged with protection property? If so, does the existence of private protection substituting for public institutions lead to an erosion in trust in and legitimacy of the substituted institutions?

iii. Does insecurity of property lead to more stereotyping along ethnic group lines? Does property insecurity cause farmers to prefer more authoritarian political leaders?

4 Experimental Design

4.1 Sampling and Recruitment

This experiment consists of a core sample, answering the main research questions, and a supplementary spillover sample that will be used to estimate the spillovers of a crime intervention.

4.1.1 Main Sample

The main sample of farmers for this experiment are drawn from the field networks of the Kenyan Agricultural and Livestock Research Organization (KALRO) in Migori

county. This region was selected for lack of ethnic hostility towards Maasai as well as proximity to Maasailand, meaning transport is feasible.

The agricultural conditions in Migori allow for planting of high-value crops in addition to local staples, and is a reasonable distance from urban centres giving an opportunity for farmers to seek off-farm employment during this planting season.

A sample of ten farmers was selected in sixty villages for a total of 600 farmers in the core sample. This sample was recruited using the farmer networks maintained by the Kenya Agriculture and Livestock Research Organization (KALRO). After sixty villages near Migori town were identified, information meetings explaining the project and intervention were conducted with leadership of the farmer's group in each village.[1] Farmer's group leadership then recruited ten interested farmers from within their group, who were then invited to a session where they signed consent forms and baseline data was collected. The sessions with individual farmers take place the week of May 28th.

4.1.2 Spillover Sample

In order to estimate the spillover effects of the intervention on the research questions, a supplementary spillover sample will be recruited. From the original sample of small geographic clusters, twenty treated clusters and ten control clusters will be selected by stratified randomisation. In each of those clusters, enumerators will be sent into the villages to record the GPS locations of the treated households. Enumerators will then conduct a convenience sample of other farming households in the village at varying distances to the households in the main sample. In total the spillover sample will include three hundred households.

4.2 Randomization Units & Method

The unit of randomization will be the village. This is motivated by the potential for interaction between treated and control, and to ensure that at least two watchmen are assigned to each village and that no watchman has to travel alone to a new place.

Clusters will be assigned to treatment using stratified randomization. Following Athey & Imbens, the ideal is to stratify as much as possible while ensuring that there are at least two treatment and two control units, so that variances can be estimated. In my case, where the share treatment is one-third, this means that to

[1] See Appendix for information session script.

have two treated in each stratum requires six village units per stratum. Within this constraint of six villages per stratum, I plan to stratify on the following variables:

i. **Village Mean WTP For Watchman**. Self-reported willingness to pay for a watchman acts as an aggregate measure of how important security is in a particular village, so is an important variable for stratification.

ii. **Village Mean Fruit & Vegetable Land Share:** The average share of land devoted to fruits & vegetables[2] gives a good indicator of the suitability of the village for different types of agricultural production, and is important to ensure the treatment and control group have similar suitability for different types of agriculture.

iii. **Village Mean Farm Size:** Farm size is an important factor in both the average wealth of farmers and in the density of households, both of which are important for ensuring balanced treatment and control in terms of production and theft risk.

In order to stratify by another variable and maintain at least 6 in each strata, it will be possibly to stratify above/below median on three variables only with a sample of 60 villages. Stratifying by the first three partitions will divide the sample into 8 strata. This stratification will be implemented and deal with misfits by the within-stratum approach, as described by Carril (2017) and Bruhn and McKenzie (2011).

4.3 Characteristics & Power

Given the sample size of 600 in approximately 60 clusters of 10 respondents each, the power calculations for my main outcomes, relating to the choice to plant theft-risky crops, are as follows. This design will be able to detect a 4% increase, corresponding to 0.26 standard deviations, in land allocated to high theft-risk crops relative to the district-level average, where high theft-risk crops are designated using objective characteristics of crops. This outcome is demeaned at the district level to account for geographic variation in crop suitability. I will also be able to detect a 3% increase in land allocated to high theft-risk crops, where high theft-risk is defined subjectively as being the crops mentioned in qualitative interviews as being theft risk.

[2]definitions in Appendix

4.4 Data Collection Methods and Instruments

Data collection will be conducted using the SurveyCTO platform on Android tablets used by survey enumerators. The exact survey instrument text is uploaded as a supporting document with this Pre-Analysis Plan.

Baseline data was collected prior to assignment to watchmen treatment as exit surveys after the consent & information sessions.[3]

Spillover data will be collected for randomly selected villages by enumerators in the villages. Respondents will visit all households in the main sample in the given villages to record their position by GPS. Enumerators then sampled neighbours and other households at varying distances to the main sample households, recording both the location of the households by GPS and the approximate walking time from the nearest main sample household.

4.5 Risk and Treatment of Attrition

Attrition is not a significant concern in this study due to the good relationship between the KALRO field coordinator and the farmers. In addition, this study takes place over a single agricultural season, so the timeline is reasonably short and it is unlikely they will have moved by the time of the endline survey, immediately after the harvest season.

5 Data

I will use a number of data source to classify crops as being theft-risky or not. First, high theft-risk is defined subjectively as being the crops mentioned in qualitative interviews as being theft risk. This will be supplemented with a more rigorously collected subjective theft-riskiness classification, with a supplementary sample of farmers rating crops on their perceived likelihood of being stolen[4], and an expert survey of a small sample of agronomists. This will be supplemented by an objective measure of theft-risk based on the following categories that qualitative evidence suggest are important for theft-riskiness:

- Price per KG
- Time to harvest

[3]See Appendix for full supplementary survey instrument.
[4]See Appendix for supplementary sample crop theft-risk survey instrument

- Sold in open local markets or consumed locally
- Time of harvest relative to most common local staple (maize)
- Baseline share of farmers growing this crop

6 Econometric Specifications and Outcomes

Following the recommendations in Athey and Imbens (2017), I estimate treatment effects both at the village and individual level. Covariates are included in the form of indicator variables, so that estimates are easily interpretable as treatment effects on subpopulations. I will estimate standard errors estimated both using the Neyman randomization inference approach suggested by Athey and Imbens (2017) and regression-based robust standard errors.

My main empirical specifications will be a regression of the outcome variable on treatment status dummy, controlling for randomization strata indicators.

In further specifications, I will include household covariates and village-level covariates.

Household-level covariates of interest (other than strata indicators) for agricultural production are as follows:

i.

Village-level covariates of interest (other than strata indicators) for agricultural production are as follows:

i.

7 Outcomes & Expected Results

7.1 Research Questions

- Does an improvement in property security allow farmers to plant more valuable crops? Does this freedom allow farmers to:
  - experiment and gain information improving future productivity?
  - test their beliefs about theft & security and possibly update overly mistrustful perceptions?

- How do concerns over property security constrain other types of economic activity?
  - Improved security is a concern for farmers who engage in off-farm economic activity. With improved security, will see more off-farm enterprises and work.
  - Broader networks and more interactions outside own community may reduce parochialism
- How does changing one person's cost of securing property impact others? This depends on the beliefs people have about those around them and the perceived nature of crime. Two scenarios:
  - *Safety in Numbers:* Fixed/Known supply of targeting (non-random) thieves. In this scenario, the effectiveness of security interventions for one farmer depend on the number of other farmers also experimenting. If people believe that the number of thieves is fixed, then more people experimenting will mean they are spread out over more targets, reducing the risk to each farmer. In this case, property rights is a sort of coordination problem, where if everyone switched to do theft-prone agriculture the risk to each individual would be much lower.
  - *Good fences make good neighbours:* Variable supply of opportunistic/random thieves. If people perceive theft to be opportunistic by nearby people, then effectiveness of security will not depend on the intensity of treatment. In this case, security will reduce suspicion of neighbours and tensions arising from uncertain property security.
- How does the existence of effective public property rights protection, or lack thereof, shape social networks? Do people have broader and shallower social interactions when they have security?
  - If mutual security (where neighbours protect each other's property) or strong relationships and mutual support (similar to gift-giving to deter theft – see Schechter) are responses to poor security, then does decreasing the cost of securing property lead to broader relationships?
- Does the existence of private property protection substitute for public institutions, reducing their legitimacy and the degree to which they are trusted?

– Does the existence of private alternatives to public institutions act through information and a comparison/stereotyping channel? Test this by looking at neighbours who are less likely to directly benefit from having protection, but will observe the competence of private watchmen and the different it makes. Does this raise the bar and make people more critical of public institutions?

7.2 Outline of Argument

Imperfect property security and the fear of theft constrain economic activity. Two examples of this are the planting of high-value stealable crops and taking work or starting enterprises away from the farm. An intervention to improve security of farms will therefore see increased land allocated to high-value agriculture and greater likelihood of pursuing economic activities away from the farm. The nature, or more accurately the *perceived* nature, of property insecurity is of great importance for understanding whether interventions in property security have broad spillovers. The existence of positive externalities would justify increased spending on security and state-building at the micro-level as valuable public goods, where private decisions focused only on direct personal benefits lead to sub-optimal investment.

I consider two broad types of spillovers. The first are direct benefits to the effectiveness of coordinating investments in security. One perceived explanation for crime in villages is that there is a fixed number of thieves that cause property risk. If this is the case, then as the number of farmers pursuing higher-risk strategies (either planting more valuable crops or pursuing more off-farm economic activities) increases then there are more potential targets for theft, and the risk to any individual pursuing higher-risk activities is lower.

The other type of positive externalities are potential indirect benefits to others through social learning, improved social cohesion and effects on legitimacy and trust in institutions. If improved property security leads to greater experimentation by farmers, the knowledge gained from this experimentation may spread to other farmers in their community. This could be direct knowledge about agricultural production, or it could be information about the actual risk of crime. As expectations of crime risk are mostly hypothetical, and not learned through own experience, then it is possible that the risk of crime is over-estimated. If farmers experiment with high-risk activities and find their security is less active and they face fewer theft attempts than expected, they may revise their expected frequency of theft events

downwards, and this knowledge may also diffuse to other farmers. If it is indeed true that *'good fences make good neighbours'* then improved farm security may reduce disputes. Farm security may also lead to broader social networks (if it causes greater off-farm employment or gives greater incentives for intra-village trade through increased specialization) and less ethnic parochialism, if out-groups are stereotyped as being responsible for crime.

7.2.1 Logic of Argument

i. Improved security relaxes constraints on crop choices and time spent on off-farm economic activities.

   (a) Agricultural Production:

      i. Subsidized farm watchmen improve subjective farm security and reduces risk of theft from planting valuable crops

      ii. With subsidized protection, farmers change their crop decisions, planting more theft-prone and higher value crops

   (b) Off-Farm Enterprises & Employment

      i. Subsidized farm watchmen improve subjective farm security and reduces risk of leaving farm unattended to do work away from the farm

      ii. Improved security should lead to more farmers taking work off-farm and starting more off-farm enterprises.

ii. Improvements to security may have positive spillovers by enhancing the effectiveness of other investments in security

   (a) Coordination problem / safety in numbers

iii. Improvements to security may have indirect benefits to neighbours:

   (a) Technology Learning: When some people have security they try new things and then learn new things. Others learn from them

   (b) Beliefs Learning: When people have security, they test whether others actually try to steal from them: learn from their watchmen about actual theft attempts, correct their beliefs.

iv. Improvements to security may have other effects the individual farmer may not value, but a social planner might:

(a) Political Opinions

i. Farmers observe they are able to protect property rights themselves.

ii. Farmers are less reliant on public institutions (local government, chief's office) for property security

iii. Substituted institutions have lower legitimacy among farmers

(b) Social Interactions & Attitudes

i. Thieves perceived to come from other groups, or non-neighbours → reduced fear of theft leads to less stereotyping

ii. Broader economic networks and more interactions outside very local area

iii. theft-prone crops are more marketable → subsidized farm protection gives greater incentive to trade and interact outside close neighbours

7.2.2 Results Testing Argument

Note: results listed in **bold** will have baseline data and higher power.

Table 1: Summary Stats.

i. Improved security relaxes constraints on economic activities.

(a) Agricultural Production – Table 2

i. **Manipulation Check: Test Treatment Effect (TE) on hiring a Watchman (binary and number of weeks)**

ii. **Test Treatment Effect (TE) on subjective/perceived farm security.**

iii. **Test TE on farmers share of land used for theft-prone crops.**

iv. **Test TE on farmers trying new crops. (1/0)**

v. **Test TE on share of land used for new crops. (1/0)**

(b) Off-Farm Enterprises & Employment – Table 3

i. **Test TE on perceived security risk from engaging in off-farm economic activity.**

ii. **Test TE on off-farm enterprises (1/0)**

iii. **Test TE on off-farm employment. (1/0)**

(c) Scale of Farming – Table 4

i. **Test TE on total amount of land planted.**

ii. Improvements to security may have positive spillovers by enhancing the effectiveness of other investments in security

(a) Coordination problem / safety in numbers – Table 4

i. **Test for heterogeneous treatment effect on main outcomes (Table 2,3) by village treatment intensity.**

ii. Test effect of having treated neighbour on perceived farm security

iii. Improvements to security may have indirect benefits to neighbours:

(a) Technology Learning –Table 5

i. Test TE on treated farmer trying new crops, learning new techniques.

(b) Beliefs Learning – Table 6

i. **TE on change in beliefs: baseline likelihood of thefts & hypothetical future beliefs on likelihood of thefts with no security**

ii. TE on whether their watchman was more/less busy than expected.

iii. TE on self-reported change in beliefs on likelihood of thefts

iv. Test effect of having treated neighbour on beliefs on likelihood of thefts

iv. Improvements to security may have other effects the individual farmer may not value, but a social planner might:

(a) Political Opinions – Table 7

i. **TE on opinion of local chief effectiveness**

ii. TE on trust of local chief

iii. TE on reliance on other institutions

(b) Social Interactions & Attitudes – Table 8

i. **TE on self-reported trust of neighbours**

ii. TE on trust game results with neighbours

iii. TE on stereotyping 'others' and ethnic out-groups as being at fault for crime

iv. **TE on self-reported trust of ethnic out-groups**

v. TE on trust game results with outgroups

vi. Test TE on on number of social relationships outside immediate neighbourhood.

vii. Test TE on on selling and trading more within-village

References

Athey, Susan and Guido W. Imbens (2017). "The econometrics of randomized experiments". In: *Handbook of Economic Field Experiments* 1, pp. 73–140.

Bruhn, Miriam and David McKenzie (2011). *Tools of the Trade: Doing Stratified Randomization with Uneven Numbers in Some Strata*. The World Bank: Impact Evaluations. URL: http://blogs.worldbank.org/impactevaluations/tools-of-the-trade-doing-stratified-randomization-with-unequal-numbers-in-some-strata..

Carril, A. (2017). "Dealing with misfits in random treatment assignment". In: *Stata Journal* 17.3, pp. 652–667.

A Crop Category Definitions

The following are variables I classify as Fruits and Vegetables:

- Amaranthus, Avocado, Banana/Plantain, Squash, Cabbage, Carrots, Dania/Coriander, Courgettes, Mito/Crotolaria, Cucumber, Eggplant, Kale, Mangoes, Melons, Miraa, Okra, Onion, Passion Fruit, Pawpaw, Peppers, Pineapple, Pumpkin, Radishes, Spider Plant, Spinach, Sweet Pepper, Tomatoes.