Livestock Asset Transfers With and Without Training: Evidence from Rwanda

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Abstract

We present evidence from Rwanda's Girinka ('One Cow per Poor Family') program that has distributed more than 130,000 livestock asset transfers in the form of cows to the rural poor since 2006. Supply side constraints on the program resulted in some beneficiaries receiving complementary training with the cow transfer, and other households not receiving such training with their cow. We exploit these differences to estimate the additional impact of receiving complementary training with the cow transfer, on household's economic outcomes up to six years after having received the livestock asset transfer. Our results show that even in a setting such as rural Rwanda where linkages between farmers and produce markets are weak, the provision of training with asset transfers has permanent and economically significant impacts on milk production, milk yields from livestock, household earnings, and asset accumulation. The results have important implications for the design of 'ultra-poor' livestock asset transfer programs being trialled globally as a means to allow the rural poor to better their economic lives.

Keywords: Livestock Asset Transfer, Training, Ultra-Poor.

JEL Classification: O13, Q12.

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I. Introduction

The world's poor lack capital and skills [Banerjee and Duflo 2007]. Many antipoverty programs aim to either relax credit constraints for poor households, or to relax constraints related to their ability to acquire human capital. For example, the spread of rural banking, provision of microfinance and asset transfer programs all represent efforts to ease capital constraints. Vocational training or cash transfers conditioned on school attendance spearhead policies attempting to tackle skill constraints. The most recent wave of policy approaches have attempted to tackle both constraints simultaneously, as embodied in various 'ultra-poor' poverty programs. These provide assets to households in the form of livestock, combined with intense training on how to utilize those assets for production.

The results from Randomized Control Trial (RCT) evaluations of these interventions are promising: Bandiera *et al.* [2013] document how one such program operated by BRAC in rural Bangladesh led, after four years, to the majority of beneficiaries to retain the livestock asset, a 36% increase in beneficiary earnings, and an 8% increase in consumption per adult equivalent. Banerjee *et al.* [2011] evaluate a comparable bundled program of livestock asset transfers and training in West Bengal and find consumption increases of 15% relative to baseline. Finally, Morduch *et al.* [2012] evaluate a similar program in Utter Pradesh, India, but find more muted impacts, perhaps because of the co-existence of a generous wage employment program operating in Utter Pradesh at the same time.

These types of livestock asset transfer and training programs are now being piloted in ten countries around the world, and policy makers are paying great attention to whether such interventions improve the economic lives of the world's poorest. As such, combined programs of livestock asset transfers and intense training are viewed as a promising way to transform the economic lives of typically landless, assetless agricultural laborers, into the economic lives more closely resembling households engaged in basic entrepreneurial activities focused around livestock rearing and the regular sales of livestock produce.[1]

[1] To get a sense of the scale and prominence of these types of asset transfer program, we note that as of 2011, BRAC's program in Bangladesh was already reaching close to 400,000 women and a further 250,000 will be reached between 2012 and 2016. Another variant of the program in which the asset transfer is purchased using a loan had reached 600,000 beneficiaries in 2011 and will reach a further 150,000 by 2016 [BRAC 2011]. As of November 2011, ten different pilots were active around the world, http://graduation.cgap.org/pilots/ (last accessed 10th of July 2014). BRAC is piloting the program in both Afghanistan and Pakistan. Other pilots are being carried out in by other

Common to all these interventions is the *simultaneous* bundling of asset transfers and training. However, each component is very costly to provide. Livestock asset transfers are necessarily expensive because animals are indivisible: even supplying one cow or buffalo to a household can increase its baseline wealth ten-fold, especially if the very poorest households, that are typically landless and assetless at baseline, are targeted [Bandiera *et al.* 2013]. Training is expensive because as targeted households tend never to have previously owned livestock, they lack the human capital to utilize livestock. Training then is necessarily intense because beneficiary households need to be taught how to look after animals across the harvesting cycle, and the birth-milk production cycle of large livestock can last up to 18 months. Given these costs, it is important to establish the returns to both training and asset transfer components. Moreover, as such programs are being rapidly rolled out around the world, as they scale-up they will begin to target slightly different populations, and will also begin to operate in economic environments that vary in the ability of local markets to provide training. It then becomes a more open question as to whether the provision of both components of asset transfers and training are equally cost effective.

The evidence we provide represents a novel first step in this direction. More specifically, we document new evidence on the additional impact of receiving training with livestock asset transfers, by evaluating Rwanda's Girinka ('One Cow per Poor Family') program that distributed a cow to each identified beneficiary household. Beneficiaries were identified by their communities to be among the poorest in the locality. Central to our research design is that the program has been jointly implemented by government agencies as well as a number of NGOs. On the government side, the main implementing agency was the Ministry of Agriculture (MINAGRI), while the largest of the NGOs involved were *Heifer International* and *Send a Cow*. As detailed in the next section, supply side constraints on government and NGO capabilities resulted in some beneficiaries receiving training with the cow transfer, and other households not receiving such training, but only the cow transfer.

We exploit these supply side constraints to estimate the impact of receiving training with the livestock transfer on household's medium term likelihood to produce milk, to trade milk, and the impacts on household's earnings and asset accumulation. While ours is not a randomized control trial, we are able to offer among the first tentative evidence on the marginal impact of complementary training in addition to

organizations in Andhra Pradesh, Ethiopia, Ghana, Haiti, Honduras, Pakistan, Peru and Yemen.

livestock asset transfers. This is key for the future design and expansion of such ultra-poor style asset transfer programs. Moreover, in contrast to current evaluations of ultra-poor programs, we document these impacts over the longer term, up to six years after the receipt of the Girinka cow for some households. Relative to some of the ultra-poor evaluations described above [Banerjee *et al.* 2011, Murdoch *et al.* 2012 and Bandiera *et al.* 2013] we also provide more detailed evidence on the mechanisms through which such programs likely generate earnings gains to households, such as the propensity to produce milk, and milk yields per animal.[2]

To evaluate the Girinka program and measure the impacts of farmers having received training with the asset transfers relative to those that only received the asset, in 2012 we surveyed 885 beneficiaries of the Girinka program. They had received their cows since 2006, with the median household having received the cow in 2009. We are thus able to assess the longer term impacts of the original provision of training bundled with the livestock asset, and again this time span is longer than that covered by the current generation of RCT evaluations of ultra-poor style livestock transfer programs. In addition to the main data collected from this sample of Girinka beneficiaries, we also conducted a survey of government sector vets that served our sample population and we conducted unstructured interviews with a number of stakeholders – most importantly with Girinka NGO partners who were responsible for the distribution of some of the cows. This provides further insights into the actual operations of the Girinka program and especially the existence and nature of supply constraints that we exploit to measure the impact of training over and above livestock transfers.

Our main results are as follows. First, households that received training with their cow are 56% more likely to be producing milk in 2012, and on average produce 1.5 liters more milk per day. This corresponds to a 162% increase in milk production over households that received no training. This increased production stems largely from increased milk yields obtained holding constant the stock of cows, rather than increased holdings of cows *per se*. Second, the increased production and sales of milk translate into significantly higher households earnings: households with training

[2] As our analysis is based on a sample of Girinka beneficiaries, our estimates measure the impact of training provision *in addition to* an asset transfer. We do not measure the impact of the asset transfer relative to not receiving anything. Hence our results have no implications for whether households should be taking up such programs in the first place. Such an analysis is conducted by Pimkina *et al.* [2013] for the cows distributed by *Heifer International* as part of the Girinka program, comparing recipients to either future beneficiaries or non-beneficiaries. Among a sample of around 4,000 households, they find substantial impacts of cow transfers on dairy and meat consumption, as well as improvements in child anthropometrics.

experience a sixfold increase in earnings from milk sales as compared to the average earnings of households that did not receive training. Moreover, the other key income gain for trained households comes through sales of animals. These income gains dwarf the monetary cost of the training supplied per farmer, generating rates of return far in excess of those that are likely to be available through other investments. Finally, the increased earnings households with training experience, translate into greater asset accumulation: households that received training with their transferred cow since 2006, are significantly more likely to own cooking stoves, bicycles and mattresses by the date of the survey in 2012.

Overall, the results show that even in a setting where linkages between farmers and markets remain weak so that the returns to training might be somewhat attenuated (say because farmers cannot capture any value added from being able to sell to urban consumers), the provision of training with asset transfers still has permanent and economically significant impacts on household's ability to produce milk, livestock productivity, earnings, and asset accumulation. In short, farmer skills related to animal husbandry matter and prior to the program there are likely to have been binding constraints on the human capital farmers had on this dimension. Attempts to improve these types of human capital are likely to yield high mean returns, as well as reducing income volatility as households are more able to rely on stable income streams from the sales of livestock produce such as milk. These type of human capital investments, for those that have long exited the formal schooling system, are an important form of antipoverty measure.

The paper is organized as follows. Section II describes the One Cow program. Section III describes our data and empirical method. Section IV presents the core findings, and Section V concludes.

II. The Girinka 'One Cow' Program

In 2011 Rwanda had a GDP per capita of just under $600, placing it in the bottom decile of the world cross-country income distribution. However, over the last decade Rwanda has witnessed strong income growth driven primarily by the services and agriculture sectors, with real GDP per capita increasing at over 5% per annum, and poverty falling by 12pp in the past five years alone [National Institute of Statistics Rwanda 2012]. However, despite this recent success, exports remain concentrated in traditional strengths of tea, coffee and minerals; at least 70% of the population still rely on agriculture for their livelihoods, more than 40% of the population live below the national poverty line that is at slightly less than $190 per annum, or 52c per day.

The Girinka ('One Cow Per Poor Family') program was initiated by President Paul Kagame in 2006 as part of the fight against rural poverty. The aim was to use livestock asset transfers to increase productivity in the livestock and agriculture sectors, and hence drive improvements in household incomes and poverty reduction among the rural poor. As of today, over 130,000 of the poorest rural families have received a Girinka cow. The program has been jointly implemented by government agencies as well as NGOs. On the government side, the main agencies involved include the Ministry of Agriculture (MINAGRI), Ubudehe (a government organization that takes a participatory approach to poverty reduction), FARG (a Genocide Survivors organization) as well as various agriculture projects such as PADEBL (Dairy Cattle Development Support Project) and KWAMP (Kirehe Community- based Watershed Management Project). The largest NGOs involved were *Heifer International* and *Send a Cow*, but there were many other smaller NGO distributors involved as well. The program aimed to genetically strengthen the population of cows by introducing higher productivity cow varieties to Rwanda. The 'exotic' cow breeds distributed have included Friesian/Holstein and Jersey varieties, as these breeds produce far more milk than the indigenous species. Crossbreeds between these varieties and the local breed were expected to perform particularly well, given their higher resistance to heat and local parasites.[3]

We now describe how the program operated, focusing on the elements key to our research design. Focusing first on what NGOs do, we emphasize that the primary role of NGOs lies in the distribution of cows. However, some Girinka providers include training as part of their programme when they give a beneficiary a cow, while others do not. Those providers that provide training typically train *all* beneficiaries to whom they give a cow. Interviews with NGOs in the sector revealed that some viewed training as an integral part of the package. For example *Send a Cow*, one of

[3]All cows were supposed to be distributed in-calf, so that the household would have a new calf and milk production within a short space of time. However, estimates from our data suggest that in reality, less than one third were actually distributed in-calf. In order for the program to be self-perpetuating, beneficiaries were obliged to "pass on the gift" by giving the first born calf to a new beneficiary household in the area (the so called "pass-on" or *kwitura* in Kinyarwanda). Where the firstborn calf is a bull, it is expected to be sold to purchase a heifer to pass on. As the price for heifers is typically higher, the purchased heifer would usually be younger than the bull sold and not yet old enough to breed.

the largest NGO partners in the program, explained their Girinka operation as being a five year process, beginning with training in preparation for receiving the cow (e.g. producing feed, building a shed) and ending with the households graduating out of poverty because they had acquired the skills to care and manage cows as a productive asset. To get a sense of the intensity of training provided, we obtained information on training costs from one of the most important NGO partners for the delivery of the Girinka program, *Send a Cow*. Their training related to animal husbandry, that takes place over seven days and to groups of farmers, was estimated to cost around RWF 7800 per beneficiary. It is this cost figure that we will later be able to compare any monetary returns generated by the training to.

Our structured interviews with providers shed some light on what leads some NGOs to provide training and others not: whether the NGO provides training with the cow is largely dependent on both their philosophy (what they perceive to be local knowledge of cows and the necessity of training), and simple differences in NGO resources. On differences in NGO philosophy, some NGOs reported choosing not to provide additional support with cow transfers for one of two reasons. First, some argued that as animal husbandry has been deeply rooted in the Rwandan culture, a body of local knowledge existed among farmers that can be passed on through social learning. While this might well be the case for traditional breeds, it would not apply to the same extent as some of the exotic breed of cow distributed through the Girinka program. In addition, an established body of evidence suggests such processes of learning can be slow, inefficient and limited by other social norms [Foster and Rosenzweig 2010]. Second, some NGO providers perceived government veterinarians to be easily accessible to farmers in case of need, and so training to already be effectively on hand to beneficiary households. However, as the data described below shows, travel times to the nearest government vets are typically quite high, so households face high fixed costs, or waiting costs, in order to be able to access such services. Moreover, these vets are often overburdened by having to serve a large number of farmers over a geographically dispersed area.

Our empirical analysis exploits the fact that different distributors of cows offered varying levels of training, support and extension services to recipients of cows. Some distributors provided cows with no complementary training at all. Other distributors hired their own veterinarians/trainers to extend services to their new beneficiaries. Some distributors also gave some form of support package along with the cow, including for example medicines, or the materials for building a shed to house the animal.

The second important element to understand for the research design is on where NGOs operate. We note first that there are multiple NGO providers in each cell (or group of villages). Girinka providers are able to choose the cells where they work. As NGOs vary in whether they provide training, there is considerable *within-cell* variation in training provision. Figure 1A shows the CDF for the percentage of trained households across cells in our sample. This variation is driven by the mix of providers operating in each cell: to reiterate, providers that do provide training typically train all beneficiaries to whom they give a cow. In the average cell, 37% of households are treated (i.e. provided training with their Girinka cow). In 25% of cells, at most 25% of households are treated, and in 25% of cells at least 20% of households are treated. No cell has more than 87% of households treated and only two cells have 0% treated. To examine if there are cell characteristics that drive the percentage of households that are treated in the cell, Figures 1B and 1C show scatterplots (across cells) of the percentage of treated households against: (i) the total number of Girinka cows given in the cell; (ii) the average monthly household expenditure in the cell. Neither figure suggests a very strong correlation between these cell characteristics and the share of treated households: a line of best fit is shown in each, and neither slope coefficient is significance at conventional levels.

The third key element of how the program operated is in terms of the selection of beneficiary households. Beneficiaries are chosen *entirely* by the local community. The involvement of the community in determining beneficiaries is akin to participatory wealth rankings that are becoming a common method by which to identify the rural poor. In a randomized evaluation of different targeting methods, Alatas *et al.* [2011] show that, compared to proxy means tests, community appraisal methods resulted in higher satisfaction and greater legitimacy. Communities are also required to take account of specific eligibility criteria for the Girinka program. The program targets the poorest households subject to them having sufficient resources to care for any transferred animal. Formal eligibility criteria were in place from 2009 onwards and these selection criteria were that the household did not already own a cow; had ownership of at least 0.3ha of land but not more than 0.75ha of land; had planted sufficient feed area (approximately 0.2ha) and had the ability to build a shed for the cow. Interviews with district and sector vets conducted as part of this study revealed that communities typically were able to select beneficiaries subject to them meeting these criteria.[4]

To be clear, NGOs are neither involved in conducting the wealth ranking nor in drawing up these beneficiary lists. Once eligible households are identified, the community then proceeds to order households on the list from poorest to richest (placing households into Ubudehe categories). Communities typically meet collectively to decide this ordering. Providers that enter a cell then have to follow these beneficiary lists when distributing cows. As such, the within-cell assignment of households into treatment (trained) and control (not trained) groups are independent of the specific provider. We then exploit the quasi-random assignment into treatment and control groups within-cells to identify the impact of training received with the cow transfer, on the medium and longer term outcomes of households.

III. Data, Descriptives and Empirical Method

A. Sampling

We use two data sources: primary data collected from a sample of Girinka beneficiaries, and a survey of government sector vets. The ideal sampling strategy for beneficiaries would have been to draw a (stratified) random sample of all distributed cows. However, no central database of all cows distributed by all partner organizations exists. Instead, hard copy lists of all cows distributed in each region are maintained by local government offices. These hard copy lists of distributed cows were provided to us by the Ministry of Agriculture and Animal Resources (MINAGRI) through the cooperation of local officials. However, while comprehensive with respect to cows originally distributed, these lists are not always updated when beneficiaries move or the transferred cow dies for example.[5]

[4] Two other points are of note. First, our field interviews with district and sector vets suggested that it is typically the poorest who receive cows first, and that while the eligibility criteria have not always been strictly followed, they typically erred on the side of providing cows to the very poorest. Second, prior to 2009 there were concerns raised that the poorest were not being well targeted by the Girinka program. There followed an investigation into the program, ordered by President Paul Kagame. As a result, the government undertook a large scale operation where more than 20,000 cows were confiscated and redistributed, although it was later determined that some who had had their cows confiscated were actually poor too (despite being local leaders) and so their names were added to the lists to receive cows again in the future.

[5] Rwanda is divided into administrative regions as follows: 5 provinces, 30 districts, 416 sectors, 2184 cells, and 14,837 villages. Hence a cell refers to a small group of villages. There are generally very low levels of migration in Rwanda. According to the latest census report from 2012, only

Girinka beneficiaries for our survey were therefore selected using a multistage cluster sample design. In the first stage of drawing our sample, 10 out of Rwanda's 30 district were selected according to their population size within provincial strata (one in Kigali, three in the South, two in each of the North, East and West). Within each district, two to four sectors were drawn according to their population size, so as to have a total of 30 sectors in the sample. In these 30 sectors complete lists of beneficiary households were obtained. Within each sector, cells (groups of villages) were chosen using probabilities proportional to population size to select two cells from each sector, for a total of 60 cells. From each cell we selected 16 beneficiary households by simple random sample (as well as four replacements for cases where beneficiaries could not be located). General operational challenges necessitated dropping one cell in the North from the sample, leaving our expected sample at 944 households. The achieved sample size was 885 beneficiary households, the shortfall being due to enumerators being unable to locate households, not due to non-response. In the empirical analysis, survey weights are used throughout.[6]

For interviews with government sector veterinarians, the sampling procedure was straightforward: each cell in Rwanda hosts one official veterinarian so that we were able to approach and interview all 30 government veterinarians that cover the 30 cells in our study sample.

10% of Rwandans live outside of the province of their birth (lifetime migration), and this includes a significant amount of urbanization. In our fieldwork we encountered very few cases where we were unable to find the beneficiary household from the list. Hence our sample is likely to be quite representative of the households that received cows up to six years ago. If the original Girinka cow was dead, the household was replaced with another from the replacement list. There were seven cases where such a replacement was required.

[6]The cell in the North was dropped due to delays in getting survey teams to the field. This was down to logistical delays, and was unrelated to the geography or location of the cell dropped. There were a few other minor adjustments to the sample. One cell in Buruhukiro sector (Nyamagabe district, Southern Province) was too small for the desired sample, so it was combined with the next smallest cell in the sector. Kagarama sector in Kicukiro was replaced by Gahanga sector, as Kagarama was too wealthy and there were not enough recipients to sample from. To deal with imperfections in the sampling frame in field, the following rules were followed: (i) all 16 selected beneficiaries should be exhausted before using replacements; (ii) where a cow had been taken away pre-2009 and redistributed within the same cell, the enumerator followed the cow to the new recipient; (iii) if an original beneficiary had moved within the same cell (e.g. between villages), they were tracked to their new village; (iv) where the cow or individual could not be traced (usually because they had moved to a different cell), a replacement was to be used; (v) where replacements were exhausted, the sector vet was asked to provide a replacement in the form of the household closest to the one originally sampled.

B. Survey Instruments

Girinka beneficiaries were administered a household questionnaire including standard modules on household demographics, income, expenditure, and an asset module related to *current* asset ownership and ownership at the *time of receiving* the Girinka cow. The questionnaire also included modules on milk production, milk sales (quantities and prices), milk transfers/gifts and own consumption of milk.[7] Around six months after the household survey was fielded, we surveyed sector vets by telephone. The survey was conducted with all vets present in areas where beneficiaries interviewed reside, implying 30 interviews (one per sector). The main purpose was to collect additional information on questions that arose during the analysis of information provided by beneficiaries. We conducted additional unstructured interviews with a number of stakeholders – most importantly with Girinka NGO partners who were responsible for the distribution of cows, and some of which provided training bundled with the cow.

C. Descriptives

Table 1 provides descriptive statistics on the sampled Girinka cow beneficiary households, where standard errors are clustered at the cell level and survey weights are used throughout. The first panel gives information on the head of household that received a Girinka cow. They have at most primary (58%) or no (34%) education, derive their main income sources from farming (91%), and have household sizes of around 5.4. Prior to the Girinka cow transfer, beneficiary households are almost assetless: they own on average three assets, which would typically be a hand-hoe (owned by 94% of the households), a radio (owned by 61%) and a mattress (49%). These characteristics of beneficiaries (having low levels of human capital, being reliant on agriculture for income and owning very few assets), very much make them resemble the world's poor [Banerjee and Duflo 2007] and those that have been targeting by other livestock asset transfer programs [Banerjee e*t al.* 2011, Murdoch *et al.* 2012, Bandiera *et al.* 2013].

The next batch of variables all highlight the geographic remoteness of households,

[7]The questionnaire included an informed consent page, which explained to beneficiaries that their participation was voluntary and reassured them that they would not be personally identifiable. Enumerators requested that beneficiaries provide verbal confirmation that they understood what is required for informed consent and agreed to participate. Verbal consent was preferred since many beneficiaries are not literate and are not comfortable signing a piece of paper that they do not understand. A copy of the questionnaire and consent form are available on request.

and their access to government veterinarians, that might be a potential substitute for any training provided with the Girinka cow. The average travel time for the sector vet to reach the cell in which the household resides is 48 minutes, and sector vets report visiting on average at least one household in the cell around once every seven days: the maximum time recorded between visits is 14 days. In short, households have limited access to sector vets, and so there are few close substitutes available for any training provided initially with the cow transfer. The data also highlights how geographically remote these households are, and consequently, they have limited access to markets. As such, the potential income gains from raising cow productivity - that might arise because of training provision - might also be limited in this context, and this can attenuate the returns to training.

The remaining rows of Table 1 describe features of the livestock transfers: the average beneficiary received the Girinka cow in 2009; 23% of these cows are pass-ons, meaning that they were not received from an NGO or the government but from someone within the community who had received a Girinka cow previously. Some NGOs track activities within the villages they operate in over time, and so such pass-ons might also be received with the same kinds of complementary training being provided by the NGO as for the original Girinka cow. Most households received a cow of the Ankole breed, a breed native to Africa. About 21% of households received either an exotic purebred, or a cow that is sufficiently highly crossbred to display most of the genetic markers of the exotic breed: these cows are typically associated with higher milk production and hence higher returns. Nevertheless, they are at the same time perceived to be of higher risk as they are less apt to cope with unpredictable fluctuations in the environment or disease outbreaks and require more careful feeding to realize their potential.

The final panel of Table 1 shows the percentage of households that report in the household survey to have received some training with the cow transfer: 30% of all Girinka beneficiaries received some type of training together with the cow, provided by the distributing organization. Training provided could either be a session concentrating on a certain topic, or combine a number of topics in one training. If a beneficiary received training with the cow, then he or she reports to have been trained on average on two topics. This is in line with information provided by sector vets who report that private NGO providers typically spread their training over two sessions. The most common topic beneficiaries report to have been trained on when receiving the cow is how to build a shed (reported by 80% of trained beneficiaries). The second most common training topic is feed (53%). Approximately a third of trained beneficiaries report to have received training on disease together with their cow. The same percentage of households received training on manure together with the cow. The final row reports the percentage of households that also received a pack of medicines or other inputs were provided with the cow: these take the form of feed, sheds, material for building shed's or micro loans. Around 14% of households report receiving such assistance at the time of the Girinka cow transfer.

Column 2 in Table 1 shows the average difference on each characteristic between beneficiary households with and without training, conditional on sector fixed effects. The corresponding p-values are reported below this difference, and these are obtained from a regression after weighting and clustering standard errors by cell, as in our empirical specification below. There are a number of significant differences between households that did and did not receive any training with their Girinka cow. However the direction of the likely biases these differences might induce are not all in the same direction. *A priori*, on some factors, those with training are likely to be worse off all else equal: they are from larger households, and reside in locations more remote from sector vets. On other factors they might be better off: they are less likely to be female headed and less likely to have received a traditional Ankole cow. On a range of other observables, such as household head's age, education levels, pre-transfer asset holdings, frequency of visits to the sector from government veterinarians, there are no significant differences between households with and without training. Taken together, this evidence highlights that it will be important to assess the robustness of the results to the inclusion of additional classes of controls.

Finally, we note that households that received training with their cow are also significantly more likely to have received a package of other inputs in the form of medicine, feed, a shed, or a loan. In our empirical analysis we will therefore be able to assess whether and how the longer term returns to the provision of training, that aim to ease *skills* constraints among beneficiaries, differ from the returns to these inputs, that essentially ease *capital/input* constraints at the time of the asset transfer.

D. Empirical Method

To evaluate the additional impact of training with the receipt of a Girinka cow transfer, we estimate the following specification,

$$y_{ics} = \alpha + \beta T_i + \gamma_1 C_i + \gamma_2 Xhead_i + \gamma_3 Xhh_i + \gamma_4 Vet_c + \delta FE_s + \epsilon_{ics}, \quad (1)$$

where, y_{ics} is the outcome of interest of household i in cell (village grouping) c and sector s; T_i equals one if household i received training from the distributing NGO or government organization; C_i are variables at the Girinka cow level: type of breed received, year the cow was received, indicator whether anything other than training was received with the cow (medicines, feed, etc.), and an indicator whether it was a pass-on; $Xhead_i$ includes information on the household head: age, gender, education level, main economic activity; Xhh_i features household characteristics: number of household members, information on household composition, type of dwelling, type of roof and floor; Vet_c includes cell level information provided by the sector vet: the number of minutes it takes him/her (the vet) to reach the cell, an indicator whether (s)he travels to the cell on foot, an interaction of these two variables, and the number of days passed since (s)he visited the cell; and FE_s are a set of dummies for each sector s to account for any unobserved heterogeneity across sectors that might determine some outcomes, such as distance to local agricultural and livestock markets.

After dropping observations with any missing values from these sets of controls, our working sample corresponds to 786 beneficiary households. Given that equal probability sampling could not be applied at every stage of the sampling process, we weight the data to be representative of the population. To account for common shocks/unobservables across households in the same location, we cluster standard errors at the cell level.[8]

In this specification, β is our coefficient of interest: it measures the strength and direction of the relationship between the outcome of interest and the training indicator. If the provision of this training is exogenous to unobservable farmer characteristics, ϵ_{ics}, $\hat{\beta}$ would consistently identify the causal additional impact of training on household outcomes among those that receive a Girinka cow. Of course, there are concerns that the provision of training is endogenously determined. For example, if beneficiaries themselves select to receive training or not, then we expect those that stand the most to gain from training to receive it. This implies $\hat{\beta}$ would be biased upwards relative to the impact of training were it to be provided to the entire population.

Our survey of sector vets and interviews with leading NGO distributors provides some insights into the validity of these concerns. In multiple interviews, including with the two largest NGO donors, *Heifer International* and *Send a Cow*, as well as with sector vets, it was repeatedly confirmed that whenever training is provided by NGOs, they often consider the training an integral part of the process. Hence beneficiaries are typically trained in groups, where the whole group receives cows over a period of time and they are encouraged to form a cooperative to be trained and learn together. Furthermore, none of the institutions interviewed identified attendance at training as a problem, which is unsurprising given that these institutions often follow up directly with their beneficiaries for monitoring and evaluation purposes. This implies that no

[8]To estimate population parameters, the data are weighted to be representative. Provincial level weights (to account for unequal provincial strata in district sampling) were calculated as the inverse of probability of being selected (number of districts in province/number chosen in province). District level weights were calculated as the inverse of probability of selection within the district (number of sectors in district/number chosen in district) multiplied by the total recipient population in each district. Sector level weights were calculated as the inverse of probability of selection within the sector (number of cells in sector/2) multiplied by the total recipient population in each sector. The sector weight was normalized such that the total of sector weights within each district is equal across districts. Cell level clusters were selected with replacement by probability proportional to size – thus the weight for each cell selected is the number of times this cell was selected (before the algorithm terminated) divided by the total number of cells (including cells selected multiple times) selected. The design weights are calculated as the product of the provincial, district, sector and cell weights, normalized to the size of the population under study (for the expected sample). As response rates varied across the sampled districts, non-response weights were also calculated. The non-response adjustment was to increase the size of the weight on each cell by the inverse of the response rate. This assumes that those missing in a particular cell are represented in an unbiased way by those who were achieved. Given that there were almost zero refusals (there was only one recorded refusal by a household that did have a cow), this is not problematic in terms of self-selection into the survey. However, because those that moved recently from one cell to another may well differ from non-movers (given Rwanda's tightly organized communities), there may be some bias where people could not be reached for this reason. The main results are robust to not weighting observations.

selection into training takes place on the side of the receiver. This information was confirmed by sector vets who all (but one) reported that organizations train all of their beneficiaries and it is *never* the case that farmers approach the organizations for training.

This all suggests that beneficiaries are not self-selecting to receive training. However, it raises the question whether organizations that provide training with the cow select their beneficiaries based on certain parameters, rendering them different to the average beneficiaries in terms of *ex ante* observables. As discussed in section 2 above, this however seems unlikely. The reason for this is the important role that the local community plays in the beneficiary selection process: at the time this is done it is typically not known whether training will be provided with the cow, or the exact form that training would take if provided. Prior to the selection criteria being formalized in 2009, there may have been less stringent application of the criteria, but even so, all selection still had to pass through community channels. The discussion of beneficiaries characteristics above from Table 1 furthermore supports that beneficiaries which received training are not systematically better or worse off than those that did not.

IV. Results

For households to successfully engage in livestock rearing, they need to: (i) maintain an animal's health; (ii) enable it to become pregnant, produce offspring and lactate; (iii) to engage in best practices to maximize milk production; (iv) store milk in a sanitary manner; (v) bring excess produce (that is not for own consumption) to market. Different types of training focus on these different pathways: training on diseases will protect the animal's health, and improved health will lead to a higher likelihood of reproduction, which contributes to sustaining and increasing the herd size and at the same time allows for milk production. Improved feeding practices would further be expected to lead to better quality and higher quantity of milk produced. Our training indicator, presented in Table 1, encompasses training on all these aspects. We would therefore expect that if the returns to training are positive, then its provision should impact the sequence of outcomes we now study from milk production, to earnings, through to asset accumulation. We analyze different aspects of the training in Section 4.6 below.

A. Milk Production

The first outcome we consider is whether the simultaneous provision of training with the cow transfer correlates to whether a household currently produces milk in 2012. Milk production is a precondition to reach the program's long-term goal of reducing poverty by improving nutrition and income. Table 2 provides probit estimates of (1) where the outcome variable, y_{ics}, is a dummy variable equal to one if the household produces milk on survey date, and zero otherwise. Milk production is recorded from *all* animals the household owns. The data does not allow us to distinguish whether the produced milk is specifically from the original Girinka cow. However we note that 82% of beneficiaries report retaining the Girinka cow: given the median household received their Girinka cow in 2009, there is some likelihood the other Girinka cows have either died or been sold. On average, each household owns 1.16 cows, with 74% of households owning one female cow, and 6% owning no cow. Hence in the majority of cases it appears as if households own exactly one cow and this is the originally transferred Girinka cow.

In Columns 1 to 6 of Table 2 we sequentially add in more classes of control variable, and report marginal effects from the probit model estimation of (1), evaluated at means of all controls. The stability of the estimate of interest $\hat{\beta}$ across these specifications is therefore informative of whether this estimate is likely to suffer from omitted variable bias from unobservables correlated to the variables we are able to control for. As can be seen across Columns 1 to 6, the sign, magnitude and significance of the coefficient on our training indicator is extremely robust across the different specifications when different sets of observables are controlled for. Column 1 simply regresses the dummy for milk production on the training indicator dummy, unconditional on all other covariates. Girinka cow beneficiary households that received some training simultaneous to the asset transfer of the cow are 15pp more likely to be producing milk on the survey date. Columns 2 to 6 show this finding to be robust to the inclusion of sector dummies, characteristics of the cow received, household head characteristics, household controls, and controls related to the sector vet characteristics. In Column 6 once all these controls are added, the marginal impact of training remains significant at the 1% level and the magnitude, 14pp, is not significantly different from the marginal impact estimated in the unconditional specification in Column 1 of 15pp.

To benchmark this magnitude we note that 25% of households did *not* receive training produce currently milk. Hence the increase of 14pp in Column 6 corresponds to a 56% increase in the likelihood of producing milk for those households that received training. In short, around 39% of households with training produce milk. To get a sense of what the maximum attainable levels of milk production might be, in the most favorable circumstances a high potential cow should calve once every 12 months and the subsequent length of milk production thereafter is 210 days for Ankole cows, 265 for crossbred and 300 for purebred cows [Argent *et al.* 2012]. This implies that under ideal circumstances found on modern intensive dairy farms, given the genetic structure of this herd, in any given survey cross section, 67% of cows should be producing milk. The beneficiaries of Girinka cows remain a long way from this ideal, but the provision of training goes a considerable way to narrow these production gaps.

Moreover, the other coefficients in Table 2 show that training is a far more robust predictor of milk production than other measures of human capital or wealth: all else equal, the education level of the household head has no impact on the likelihood of producing milk, and the various proxies of household wealth (assets owned prior to the Girinka transfer, whether the household's dwelling is a single structure, whether the roof is made of tiles, and whether the floor is made of earth/dung), do not correlate to whether the household produces milk once other covariates are conditioned on.

B. Uses of Produced Milk

The next set of results in Table 3 focus on the quantity of milk produced, and the uses of this milk: whether it is consumed, given away, or sold. For completeness, Column 1a replicates our preferred specification from Column 6 of Table 2 on whether the household produces milk. Column 1b estimates the amount of milk currently produced (in liters) using a Tobit specification (setting households that do not produce milk to zero). This shows, in line with the increased likelihood of producing milk, that households that receive training also significantly increase the *quantity* of milk produced. On average, a household that received training produces 1.5 liters of milk more per day than Girinka beneficiaries that received no training with their cow transfer. This compares to an average daily production of slightly less than one liter per day for households that did not receive training. All else equal, the provision of training therefore increases the quantity of milk produced by 162% on average.[9]

[9]These levels of milk production from cows are lower than those reported in Anagol *et al.* [2012] based on survey data for cows in rural India in 2007: they report daily milk production of between two and three liters per cow for most stages of the lactation cycle. Pimkina *et al.* [2013] evaluate the impact of the cows distributed by Heifer as part of the Girinka program, finding substantial impacts

Such an increase in milk production can of course be a result of two different channels: an increase in the herd size and/or an increase in the productivity of a given animal holding constant herd size. We later present evidence on herd size when we consider the impact of training on asset accumulation more broadly. On productivity per animal, the result in Column 1c of Table 3 shows the previously documented increase in milk production is to a large extent driven by an increase in the productivity of cows, holding constant herd size. On average, each female cow owned by a household that received training produces 1.15 liters more than for a household that received no training. As with the likelihood to produce milk, other measures of the human capital of the household head and proxies for household wealth are not much correlated with the quantity of milk produced once all other factors are controlled for.

The remaining Columns of Table 3 explore what uses household put produced milk to. More specifically, we examine whether (and if so by how much) the training impacts household behavior in terms of their milk consumption and/or their decision to give away or sell the home produced milk. Columns 2a-2b analyze milk consumption, Columns 3a-3b examine milk given away, Columns 4a-4b examine milk sold to friends and neighbors, and Columns 5a-5b analyze milk sold through local markets.

We see the provision of training significantly increases the likelihood that households consume their own milk, as well as reporting that they sell some of their produced milk to friends and neighbors. The marginal impact on the likelihood of milk being used for own consumption is nearly three times that on sales of milk to others in the village. This is as expected given the low levels of milk consumption among beneficiary households. However, on the intensive margin we do not find any impact of training on the quantities of milk consumed (Column 2b). In contrast there is a significant increase in the amount of milk sold to friends and neighbors. Households that received training are 5.4pp more likely to sell milk to their peers and they sell on average 1.24 liters more to them.[10] Taken together these findings suggest that there

of cow transfers on dairy and meat consumption. There is a longstanding literature examining the impacts of livestock ownership through the availability of animal source foods, that are an important source of nutrients in such rural economies, and through the mitigation of seasonal fluctuations in food crop availability [Murphy and Allen 2003].

[10] A typical household in the sample consumes on average 1.1 liters of milk per day of their home produced milk, which (based on the average household size of 5.35) translates into approximately 75 liters per person per year. While this puts our sample far below the recommended consumption figures of the World Health Organization and Food and Agriculture Organization, which lie at 200 and 90 liters of milk per person per year respectively, it is at the same time much above the

is a relative shift towards selling or giving away milk as production increases. Hence the *proportion* of own-produced milk that is consumed, falls as production increases, even though total consumption increases.

For the other types of milk use (giving away milk or selling it through local markets), there are no impacts on either the extensive margin of the frequency with which such milk-transfers take place, nor on the intensive margin of the quantity of milk that goes through such channels. On why beneficiaries with training appear to sell more to peers than to others, it might be that given the remoteness of these households, access to markets remains poor and the fixed cost of traveling to them remain too high, especially given milk is perishable. We also note that the data suggests neighbors pay the highest price for the milk: this might be because watering down milk - and hence reducing its quality - is more easily monitored by neighbors.

C. Earnings

Given the evidence suggests households sell more milk as a result of having received training with their Girinka cow transfer, the next natural outcome to consider is household earnings from milk sales. Table 4 presents these results where the dependent variables relate to current daily milk production and its value (Columns 1a-1b), earnings from current daily milk production (Columns 2a-2b), and earnings from milk production in the last month (Columns 3a-3b). To calculate the value of daily production produced by household i, V_i^{milk}, we need to price milk that is self-consumed. To do so, we multiply the number of liters currently produced per day times the relevant price of milk, so that,

$$V_i^{milk} = \begin{cases} \bar{p}_{s-i} * Q_i^{mc} & \text{if } Q_i^{ms} = 0 \\ p_i * Q_i^{ms} + min[p_i; \bar{p}_{s-i}] * Q_i^{mc} & \text{otherwise} \end{cases} \quad (2)$$

where Q_i^{ms} is the quantity of milk sold (in liters) by household i, Q_i^{mc} is the quantity of milk consumed by household i, p_i is the price received by household i for the liters of milk they actually sell, and $\bar{p}_{s-i}$ is the median price in a cell received by other households that sell milk. In our sample, the median price of a liter of milk varies around RWF100 to RWF200.

Unsurprisingly given the earlier findings on milk production and milk usage, we

Sub-Saharan Africa average per capita milk consumption of 10.5 liters in 2010-12 (OECD, 2013).

find that training significantly increases the value of the home produced milk by on average RWF 514 per day (Column 1b). This translates into an increase of daily household income by US.82¢, equivalent to almost 66% of a non-trained household's daily income. In line with the earlier results on animal productivity, we also confirm that most of the earnings increase occurs through increased earnings *per cow* per day from milk production: these rise by RWF 422 (not shown).

Column 2a shows that beneficiaries with training are 9pp more likely to currently have earnings from *actual* milk sales (as is consistent with the evidence from Table 3 on the uses of non-consumed milk); Column 2b shows the corresponding earnings increase is on average RWF 340. This result is not only highly significant statistically, but also economically significant: it is a sixfold increase in earnings as compared to the average earnings of households that did not receive training. The increase is lower when we consider the reported earnings in the last month (Columns 3a-3b), but trained households are still estimated to have earned three times as much within the last month than those households that were not trained. Taken together, these findings on earnings show that even if market linkages remain weak, the monetary returns to training provision remains high through sales to other households within the same village.[11]

It is possible that households that received training substitute labor or capital away from other activities towards dairying. If this was the case, we would find the effects on total household earnings to be smaller than the effect on dairy activities. Our evidence suggests however that this is not the case. Once the top 2% of total income observations are trimmed, households that received training have significantly more sources of income (Column 4a) and the impact on total household earnings in the month preceding the survey is quantitatively almost identical to the one on earnings from milk production over the same period (Column 4b).

To gauge the rate of return to the training provided, we compare this daily monetary return of RWF 514, to the per beneficiary cost of training provision (but ignoring any additional costs households incur in producing the additional revenues).[12] We

[11]Given that the demand for milk is relatively constant over the year, it is also likely that the provision of training helps to reduce the volatility of earnings to households, not just raise the mean level of earnings. Such mechanisms are explored in more detail in Bandiera *et al.* [2013].

[12]While we do not have detailed information on the additional costs households might incur in obtaining the additional return, we note that on transportation costs for milk only a few households report positive out-of-pocket costs (for the majority the cost likely represent the opportunity costs of time). The same applies to the costs of transporting feed.

obtained information on training costs from one of the most important NGO partners for the delivery of the Girinka program, *Send a Cow*. Their animal husbandry related training, that takes place over seven days and in groups of farmers, was estimated to cost around RWF 7800 per beneficiary. Hence a comparison of costs and benefits suggests the provision of training would break even if the daily earnings gains documented above of RWF 514 were maintained for only 15 days of the year. As a point of comparison, we note that in ideal circumstances, after calving, cows typically produce milk for approximately 10 months. In our setting, even after taking into account all the differences from ideal circumstances for animal husbandry, the provision of training is likely to deliver higher milk yields for a number of months, yielding an effective rate of return far higher than 100% for those farmers for whom the training does lead to a higher likelihood of milk production. There are unlikely to be many other types of investment available to beneficiary that yield such returns in the same time frame.[13]

This calculation is valid for those households that produce more milk as a result of the training. The earlier results showed that the provision of training leads to around 14% more households producing milk in the first place. Factoring this into the calculation, the *ex ante* expected increase in the value of milk production is .14 x 514 = RWF 72, and so the entire program would break even if farmers maintained the higher milk yields documented above for 108 days. Again this is likely given the usual 10 month period over which cows normally supply milk.

D. Herd Size and Asset Accumulation

As discussed above, the observed increase in household's milk production can be driven by higher productivity of individual cows, or by an increase in the number of cows producing milk. We earlier documented the impact of training on the productivity per cow, and now turn to analyze the impact of training on overall herd size. Training can impact different channels leading to stable, or increased, herd sizes. For example knowledge on when and how to inseminate an animal can increase the success rate of breeding and calving, which in turn leads not only to an increase in herd size without having to purchase animals, but also to milk production. Training

[13]It would be reasonable to suppose there are additional fixed costs associated with training provision, or costs associated with first registering farmers for such training. However, the basic point remains: the returns to training with the Girinka cow yields large returns.

on diseases on the other hand prevents animals from dying and hence helps maintain constant herd sizes, all else equal.

We look at the impact of training on the herd size in Column 1 of Table 5. While the coefficient is positive, it is not significantly different from zero. More interestingly though, from the remaining columns we learn that while the herd size remains stable, households that were trained have significantly more calves born to their farm (Column 2), and they sell significantly higher numbers of cattle (Column 4). It hence becomes clear that training not only increases productivity of animals but also helps the households to breed more animals. Calving of course increases milk production directly, but also allows the household to sell animals.

Column 6 begins to examine how households uses these various sources of additional income from increased milk sales and sales of young calves: specifically we can check whether households that received more training with their original Girinka cow are able to accumulate more assets today (recall that as shown in Table 1, households with and without training report similar assets *prior* to the Girinka transfer). No information was collected on savings, although we note that an established earlier literature has suggested that livestock is often the most important savings device or store of value for the rural poor, as alternative forms of informal or formal savings devices rare [Rosenzweig and Wolpin 1993]. Households were asked about what types and how many tools and assets they own, for thirteen different items. The households were also asked to report how many of these assets were purchased *after* receiving the Girinka cow. In Column 6 of Table 5 we present results for the total number of asset types owned by the household. In Appendix Table A1 we present more detailed information by each asset type on whether it is owned and the number owned for a subset of asset types (cellphone, bicycle, stove, and mattress).

We find that households that received training own significantly more types of assets (on average .27) and also own a significantly larger number of assets (.67 more). Of the thirteen items the households were asked about, they own on average 3.2 at the time the Girinka cow was provided to them. A coefficient of .27 on the training indicator hence implies an eight percent increase in types of assets owned if compared to non-trained households. The number of assets owned increased by about 14%. Both results are highly significant. In Table A1 we find that this result is predominantly driven by an increase in stove ownership (Columns 4a and 4b). The mean of stove ownership for non-trained households is 27%. Households with training are 13pp more likely to own a stove. We also find that training impacts the likelihood of owning a bicycle positively (Column 3a) and households that are trained seem to invest in a greater number of mattresses (Column 5b).

E. Impacts by Year of Transfer

Our sample covers Girinka beneficiaries that received cows since 2006. We now explore how the main outcomes vary by year of transfer of the Girinka cow. The sample median year of receipt is 2009, three years before our survey. Around 30% of households received their cow in or before 2008, 20% in 2009, 25% in 2010 and 20% in 2011 or later. To the extent that similar recipients are targeted over time, this variation allows us to better understand how the complementarities between training and cow transfers are shaped over time. In many cases we expect training to lead to self-perpetuating gains over time to households in terms of milk production and calves sold. We focus on the main outcomes investigated in Section 4: whether the household produces milk, the amount of milk produced, earnings from daily milk production, and the number of cows sold. To understand how impacts differs by year of the transfer, we extend our baseline specification in (1) by allowing for a series of interactions between the year of transfer and the training indicator.

Figure 2 plots these interactions for the outcome for whether any milk is produced. We see that, except for beneficiaries who received the Girinka cow in 2007, training provided with the cow increases the probability of currently producing milk for each year of transfer. The difference between trained and untrained households is significant for cows provided in 2008 and 2010.[14] Reassuringly, we see the predicted probability of producing milk dropping sharply for all households who received the cow in 2011 (trained and untrained). Given that milk production is conditional on the cow giving birth, which would usually not happen so quickly after the cow is received, this is an expected finding. Figure 3 shows a very similar pattern is found when considering the impact of training received with the cow on the *quantity* of milk currently produced. Again, differences between trained and untrained households differs for training received in 2008 and in 2010 are significantly different from zero at conventional levels.

[14] Note that to test for the statistical significance of the interaction effect between trained and untrained beneficiaries, we estimated cross-partial derivatives of the interaction effects. This is necessary when dealing with interaction terms in nonlinear models [Norton *et al.* 2004], that is a probit specification in this case and Tobit specifications in the remaining outcomes we discuss.

Figure 4 shows the heterogeneous impacts of training by year of Girinka cow transfer for current earnings from selling milk. We again find that the longer ago the training was received, the higher the impacts are on earnings from selling milk. However, while marginal impacts for trained beneficiaries are always above those of untrained ones, the difference is only significant when the cow was received one or two years previous to the survey (in 2010 the difference is significant at the 1% significance level, in 2009 at the 10% level). Finally, we consider the number of cows sold since the Girinka cow was received. We find the impacts of training are notably higher the longer ago the cow and training were received: cows received more recently simply have not had the time to produce offspring that could have been sold. More importantly, this finding is considerably sharper for trained households, the left had side of Figure 5 shows, with the differences among cows received in 2006 and 2007 being significantly different from zero.

These results are informative for the future evaluation of training bundled with livestock asset transfer programs: the returns to training vary over time and can be long lasting. We have documented positive returns to training up to six years after the initial asset transfer. For some of the most important means through with asset transfer programs increase incomes - such as sales of calves - such outcomes necessarily take time to be realized and so will not be picked up in very short run evaluations.

F. Training Types

The analysis has so far exploited the fact that different distributors of cows offered varying levels of training, support and extension services to recipients of cows. Some distributors provided cows with no complementary training, and others hired their own veterinarians/trainers to extend services to their new beneficiaries. We now focus on two other elements of the Girinka program and compare these features to the provision of training. First we note that some distributors also gave some form of support package along with the cow, including for example medicines, or the materials for building a shed to house the animal. Hence our next set of results show the impact of receiving such packages, that take the form of easing *capital* constraints on the margin, rather than *skills* constraints, controlling for the receipt of training. This helps address the concern that our previous results are merely picking up the receipt of this package rather than anything to do with the returns to training.

Second, we note that one of the justifications for NGO distributors not providing training was that some perceived government veterinarians to be easily accessible to farmers in case of need. Our survey instrument collected information on whether individuals had received any training from sector vets. Hence our next set of results now additionally control for such training having been received. When sector vets offer training, they often do so to groups of individuals in a village. In our survey of sector vets, the majority of them reported that either everybody in a village (reported by 55% of vets) or every farmer in a village (reported by 35% of vets) is invited to attend a training. Only 7% of vets stated that they select participants based on need and only 11% said they decide to help a household or give them advice when they are visiting them for other reasons.

As expected, there is strong evidence for households themselves demanding the type of group training session from vets described above. All but one of the 30 sector vets stated that farmers approached them requesting training and the type of training provided by the sector vets is very closely in line with the type of training demanded by the farmers. This raises the concern that the indicator for having received training from the sector vet is endogenous and likely biased upwards as better or more needy farmers may have demanded such services in the first place.

The results are in Table 6. As in the previous section we focus again on on the main outcomes investigated in Section 4, now also including the number of assets owned. We note that across most outcomes, in these specifications where we also control for training from sector vets, the indicator for training received with the Girinka cow remains positive, significant and of similar magnitude to the earlier results. Two additional robust findings emerge.

First, the provision of training from sector vets has little significant impact on these outcomes of interest. Even if such training is sought out endogenously, it appears to be not much correlated with later milk production, earnings and asset accumulation. This might tentatively suggest that the returns to training are especially high when provided at the same time as livestock asset transfers, but that training provided subsequently has far lower returns. This in turn might be because such training is only sought, and only provided with some delay, when outcomes are deteriorating with regards to livestock production. An alternative explanation for the low returns to training received from sector vets is that the *quality* of training that sector vets are able to provide is just much lower than that provided with Girinka cows. Indeed, 72% of sector vets interviewed indicated that it was in their job description to provide "advice" rather than training, suggesting that the nature of sector vet training may have been less formal. Sector vets also identified their training on a particular topic to be composed on average of fewer sessions (1 as compared to 2), and of shorter length (3.1 hours as opposed to 4.9 hours) relative to NGO offered training.

Second, the results in Table 6 also show the provision of packages of medicines and other inputs at the same time as asset transfers has little significant impact on the outcomes of interest, indeed a number of the coefficients have negative point estimates. This suggests that easing capital constraints slightly at the same time as livestock asset transfers is far less effective than such transfers being bundled with the provision of training.[15]

Both these results are informative for the design of future livestock asset transfer programs: training should be provided, there should not necessarily be a reliance on existing public sector vets as a source of training to farmers, and the provision of other inputs such as medicines, appears less effective in this setting than the provision of training *per se*.

V. Conclusions

The Girinka One Cow policy is an ambitious and extensive asset transfer program, with over 130,000 livestock distributed to the rural poor in since 2006. The program provides a first opportunity to study the impacts of combining training with livestock asset transfers, relative to only providing livestock assets. We are able to do so because we note that the Girinka program was jointly implemented by government agencies and NGOs. The role of NGOs lay predominantly in the the distribution of cows. Given NGOs varied in their capacity to provide training alongside cows, we observe some beneficiary households only receiving cow transfers and others receiving cows with complementary training. As farmers themselves do not self-select to receive training, but rather the provision of training is driven by supply/capacity constraints faced by NGOs, the assignment of training is plausibly exogenous to other factors that drive outcomes related to milk production, livestock productivity, household earnings and assets, as measured up to six years after the initial livestock asset transfer.

[15] We have also explored in finer detail how these main impacts vary by the type of training received: we find that some impacts are driven by training in shed building, although all types of training are significant for at least one outcome considered.

Our results show that even in a setting where linkages between farmers and markets remain weak - that might attenuate the returns to training all else equal say because farmers are unable to sell at high prices to urban consumers, the provision of training with asset transfers still has permanent and economically significant impacts on household's milk production, livestock productivity, earnings, and asset accumulation. This training is found to be far more effective for these outcomes of interest than the availability of subsequent training from local government vets, or the provisions of small amounts of capital inputs provided with livestock asset transfers. The rate of return to the provision of training is high and likely larger than for other investments available to beneficiary households: even a conservative estimate suggests training costs would be recovered and the program break even if the training allows households to obtain higher milk yields for three additional months of the year. As a point of comparison we note that in ideal circumstances, cows usually produce milk for 10 months after calving. Moving forward, the findings suggest the crucial complementarity between asset transfers and training provision, the impacts of which persist over time, and for many outcomes, the impacts are self-perpetuating and increase in magnitude over time.

We view the next step in the research agenda to be the implementation of an RCT to identify the impact of training with livestock asset transfers, either in the context of an 'ultra-poor' program, or a livestock transfer program more broadly. We thus view our findings as providing novel, suggestive evidence on the way forward for research into the optimal design of such ultra-poor style livestock asset transfer programs. Our findings provide a timely input into the design of ultra-poor programs, as these have received much attention among policy makers as being a new model by which to alleviate poverty among the rural poor: such programs are indeed being trialed in many countries around the world, and the original program operated by the NGO BRAC in Bangladesh is due to reach almost one million of the poorest households among the rural poor by 2016. Moreover, our results are also informative for the growing number of livestock donation programs, that are seen as key way to transfer resources to rural households in the developing world. For example, *Heifer International*, a leading NGO involved in animal donations, operates in over 128 countries, including Rwanda, and has donated millions of animals during its lifetime.

Our results suggest that capital in the form of livestock, and skills are complementary. The skills training takes place in a few days and covers topics such as how to build sheds for cows, what to feed cows, and trainings on disease and manure. This type of training is not expensive, certainly not compared to the kinds of intense training currently provided by many ultra-poor programs that can last between 12 and 24 months. Yet our results document that even such rudimentary forms of training generate large and long lasting positive benefits across a wide variety of outcomes of interest. Our finding on the complementarity between livestock assets and training builds on other recent work, in a variety of spheres of the development literature, suggesting the availability of capital might not be sufficient to change occupational choices among the poor in the absence of complementary training, and training might not be sufficient without capital.[16]

We also document the impacts of the complementarity of asset transfers and training over the longer term, up to six years after the receipt of the Girinka cow for some households, effectively extending the time period that current evaluations of ultra-poor programs have been able to cover. We also provide more detailed evidence on the mechanisms through which such programs likely generate earnings gains to households, such as the propensity to produce milk, milk yield per animal, and herd sizes. As such our findings suggest that future work - informed certainly by randomized control trials - should investigate the *optimal* design of training to bundle with asset transfers. This will become increasingly important as such programs are rolled out to different populations that vary in their links to markets, pre-existing levels of knowledge of livestock rearing, and availability of alternative sources of training such as government and private sector vets.

VI. References

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Table 1: Descriptive Statistics on Girinka Cow Beneficiaries

			(1) Mean (std.dev.)	(2) Difference Between Beneficiary Households With and Without Training, Conditional on Sector Fixed Effects [p-value]
Household Head Characteristics	**Age**	Age of the household head	47.027	0.277
			(13.261)	[0.962]
	Gender	=1 if the household head is female, 0 otherwise	0.321	-0.064
			(0.467)	[0.089]
	No Education	=1 if the household head has no education, 0 otherwise	0.331	-0.050
			(0.471)	[0.212]
	Primary Education	=1 if the household head has some primary education, 0 otherwise	0.579	0.056
			(0.494)	[0.187]
	Occupation	=1 if the household head is farmer, 0 otherwise	0.912	0.045
			(0.283)	[0.129]
Household Composition	**Household Members**	Nr of household members	5.424	0.583
			(2.175)	[0.001]
Asset Holding	**Number of Assets Owned Before Girinka Cow**	Nr of assets the household owned before receiving the Girinka cow	2.155	-0.011
			(1.731)	[0.924]
Information from Sector Vet	**Travel - Minutes**	Number of minutes it takes the sector veterinarian to reach the cell the household lives in	48.849	0.492
			(48.853)	[0.103]
	Travel - Walking	=1 if the sector vet walks to the cell the household lives in	0.234	-0.009
			(0.424)	[0.026]
	Travel - Last Visit (days)	Nr of days since the sector vet visited the cell the household lives in last (from mid August 2012)	6.833	0.392
			(12.469)	[0.266]
Information on Girinka Cow	**Year Cow Received**	The year in which the household received the Girinka cow	2009	-0.344
			(1.582)	[0.006]
	Cow is a Pass-on	=1 if the Girinka cow was a pass-on, 0 otherwise	0.226	-0.018
			(0.419)	[0.434]
	Breed - Traditional (Ankole)	=1 if the breed of the Girinka cow is reported being Ankole, 0 otherwise	0.454	-0.141
			(0.498)	[0.007]
	Breed - Exotic (Fresian, Holstein, Jersey)	=1 if the breed of the Girinka cow is reported being Fresian, 0 otherwise	0.415	0.141
			(0.493)	[0.009]
Training	**Training Received with Girinka Cow**	=1 if the household received training with the cow	0.298	n.a.
			(0.458)	
	Medicines or Other Inputs Received with Girinka Cow	=1 if medicines or other (feed, shed, loan) given with cow	0.14	0.117
			(0.347)	[0.008]

Notes: The Table shows summary statistics for selected characteristics for all households in our sample. The panel relate to characteristics of the household head, household composition, asset holdings prior to Girinka cows being distributed, information obtained from sector vets, information related to the Girinka cow and on training received. Column 1 shows the mean of each characteristic in the main working sample based on 786 household observations. Column 2 shows the difference between those that did and did not receive training with the Girinka cows, with the p-value below in square brackets, where these allow for weighting the observations and clustered standard errors by cell.

Table 2: The Provision of Training and Current Milk Production

Dependent Variable: Whether Milk is Produced [0/1]
Standard Errors Clustered by Cell
Probit Regression Model, Marginal Effects Reported

	(1) Unconditional	(2) Sector Dummies	(3) Animal Controls	(4) Household Head Controls	(5) Household Controls	(6) Sector Vet Controls
Training Received with Girinka Cow [yes=1]	0.150***	0.165***	0.141***	0.146***	0.134***	0.140***
	(0.0460)	(0.0540)	(0.0532)	(0.0518)	(0.0512)	(0.0519)
Household Head has Some Primary Education [yes=1]				-0.0184	-0.0224	-0.0151
				(0.0460)	(0.0451)	(0.0455)
Household Head has Some Secondary Education [yes=1]				-0.0833	-0.0596	-0.0619
				(0.0888)	(0.0923)	(0.0921)
Number of Assets Owned Before Girinka Cow Received					-0.00950	-0.00979
					(0.00873)	(0.00879)
Household Lives in a Single Structure [yes=1]					-0.0230	-0.0205
					(0.0562)	(0.0573)
Roof Made of Tiles [yes=1]					0.0561	0.0533
					(0.0631)	(0.0634)
Floor Made of Earth/Dung [yes=1]					0.0170	0.0198
					(0.0567)	(0.0570)
Sector Dummies	No	Yes	Yes	Yes	Yes	Yes
Animal Controls	No	No	Yes	Yes	Yes	Yes
Household Head Controls	No	No	No	Yes	Yes	Yes
Household Controls	No	No	No	No	Yes	Yes
Sector Vet Controls	No	No	No	No	No	Yes
Observations (clusters)	786 (59)	786 (59)	786 (59)	786 (59)	786 (59)	786 (59)
Outcome mean for untrained HHs	0.250	0.250	0.250	0.250	0.250	0.250

Notes: *** denotes significance at 1%, ** at 5%, and * at 10% level. The dependent variable in all columns is a dummy variable equal to one if the household currently produces milk, and zero otherwise. All columns report probit estimates, where marginal effects are reported in each case. Standard errors are in parentheses that allow for clustering by cell. Survey weights are used throughout. All columns control for the indicator of whether training is received with the Girinka cow. Column 2 includes a complete series of sector dummies. Column 3 includes for characteristics of the Girinka cow received (breed, year cow was received, indicator whether it was a pass-on, whether it was bundled with medicines or other inputs), information on the household head (age, gender, education level dummies for primary and secondary schooling, a dummy variable for whether the main occupation of the household head is in farming), household characteristics (number of household members, a series of controls for the demographic composition of the household, the type of dwelling, type of roof and floor), information received from sector vets proxying for accessibility (number of minutes to reach the cell, whether the vet reaches the cell by walking there, an interaction of the two, and the number of days passed since the sector vet visited the cell).

Table 3: The Provision of Training and Uses of Milk Production

Standard Errors Clustered by Cell

	(1a)	(1b)	(1c)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
	Milk Produced?	Amount of Milk Produced	Amount of Milk Produced per Animal	Produced Milk Consumed?	Amount of Produced Milk Consumed	Produced Milk Given Away?	Amount of Produced Milk Given Away	Produced Milk Sold to Friends and Neighbors?	Amount of Produced Milk Sold to Friends and Neighbors	Produced Milk Sold Through Local Markets?	Amount of Produced Milk Sold Through Local Markets
	Probit	Tobit	Tobit	Probit	Tobit	Probit	Tobit	Probit	Tobit	Probit	Tobit
Training Received with Girinka Cow [yes=1]	0.140***	1.506**	1.145**	0.158***	0.376	0.0186	0.491	0.0542*	1.236*	0.0328	1.472
	(0.0519)	(0.669)	(0.513)	(0.0509)	(0.315)	(0.0286)	(0.416)	(0.0304)	(0.641)	(0.0244)	(1.011)
Household Head has Some Primary Education [yes=1]	-0.0151	-0.257	-0.391	-0.0419	-0.0233	0.0272	0.394	0.0114	0.256	0.00819	0.520
	(0.0455)	(0.557)	(0.540)	(0.0541)	(0.310)	(0.0375)	(0.563)	(0.0223)	(0.562)	(0.0186)	(1.044)
Household Head has Some Secondary Education [yes=1]	-0.0619	-0.593	-0.745	-0.112	0.0939	0.173**	2.112***	-0.0383*	-1.100	-0.0245	-1.268
	(0.0921)	(1.198)	(0.943)	(0.114)	(0.593)	(0.0806)	(0.734)	(0.0215)	(0.933)	(0.0206)	(1.808)
Number of Assets Owned Before Girinka Cow Received	-0.00979	-0.126	-0.0769	-0.00279	-0.0166	-0.000791	-0.0373	0.00572	0.182**	-0.00920**	-0.501**
	(0.00879)	(0.125)	(0.0940)	(0.00923)	(0.0584)	(0.00397)	(0.0630)	(0.00373)	(0.0893)	(0.00369)	(0.225)
Household Lives in a Single Structure [yes=1]	-0.0205	-0.0460	-0.347	-0.0479	-0.161	0.0118	0.117	-0.0410	-1.044	0.0113	0.578
	(0.0573)	(0.851)	(0.638)	(0.0735)	(0.492)	(0.0439)	(0.687)	(0.0437)	(0.838)	(0.0175)	(1.301)
Roof Made of Tiles [yes=1]	0.0533	0.447	0.257	0.0320	0.122	0.0226	0.279	0.0488	0.997	-0.0374**	-2.272**
	(0.0634)	(0.832)	(0.705)	(0.0617)	(0.324)	(0.0297)	(0.462)	(0.0375)	(0.872)	(0.0175)	(1.125)
Floor Made of Earth/Dung [yes=1]	0.0198	-0.344	-0.175	0.0582	-0.0150	0.0409	0.677	0.0538***	1.929***	-0.0982*	-3.569***
	(0.0570)	(0.757)	(0.584)	(0.0757)	(0.388)	(0.0269)	(0.508)	(0.0167)	(0.744)	(0.0501)	(1.187)
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household Head Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Vet Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Animal Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (clusters)	786 (59)	786 (59)	738 (59)	786 (59)	738 (59)	578$^+$ (44)	578$^+$ (44)	624$^+$ (47)	624$^+$ (47)	612$^+$ (44)	612$^+$ (44)
Outcome mean for untrained HHs	0.250	0.909	0.704	0.437	1.124	0.123	0.176	0.098	0.235	0.082	0.300

Notes: *** denotes significance at 1%, ** at 5%, and * at 10% level. The dependent variable across columns changes. Specifications related to whether any milk is produced, consumed, given away, sold to friends/neighbors or sold to local markets (Columns 1a, 2a, 3a, 4a, 5a) are estimated by probit models, where marginal impacts are reported. Specifications related to the quantities of milk produced, consumed, given away, sold to friends/neighbors or sold to local markets (Columns 1b, 2b, 3b, 4b, 5b) are estimated by tobit models. The smaller sample size in some columns is then is due to some households consuming all the milk they produce. Standard errors are in parentheses that allow for clustering by cell. Survey weights are used throughout. All columns control for the following covariates in addition to the indicator of whether training is received with the Girinka cow: a complete series of sector dummies, characteristics of the Girinka cow received (breed, year cow was received, indicator whether it was a pass-on, whether it was bundled with medicines or other inputs), information on the household head (age, gender, education level dummies for primary and secondary schooling, a dummy variable for whether the main occupation of the household head is in farming), household characteristics (number of household members, a series of controls for the demographic composition of the household, the type of dwelling, type of roof and floor), information received from sector vets proxying for accessibility (number of minutes to reach the cell, whether the vet reaches the cell by walking there, an interaction of the two, and the number of days passed since the sector vet visited the cell). + The drop in sample size is due to households that consume all the milk they produce.

Table 4: The Provision of Training and Earnings from Milk Production
Standard Errors Clustered by Cell

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
	Producing Milk?	**Value of Total Daily Milk Production**	**Any Earnings from Daily Milk Production?**	**Earnings from Daily Milk Production**	**Any Earnings from Milk Production in Last Month?**	**Earnings from Milk Production in Last Month**	**Number of income sources**	**Total household earnings in last month** (Trimmed >98th percentile)
	Probit	**Tobit**	**Probit**	**Tobit**	**Probit**	**Tobit**		
Training Received with Girinka Cow [yes=1]	0.140***	514.3**	0.0931***	339.6***	0.0636*	6,026*	0.166**	6,060**
Household Head has Some Primary Education [yes=1]	-0.0151	-102.8	-0.0245	-111.1	0.0165	649.5	0.0170	524.4
	(0.0455)	(179.1)	(0.0306)	(130.6)	(0.0317)	(3,887)	(0.0583)	(2,175)
Household Head has Some Secondary Education [yes=1]	-0.0619	-342.1	-0.0762***	-481.6**	-0.0617**	-5,592	0.270	13,476*
	(0.0921)	(367.8)	(0.0199)	(234.9)	(0.0308)	(6,976)	(0.176)	(7,141)
Number of Assets Owned Before Girinka Cow Received	-0.00979	-35.64	-0.00169	-8.892	-0.000557	19.83	0.0246*	950.5*
	(0.00879)	(38.20)	(0.00417)	(20.10)	(0.00552)	(701.4)	(0.0141)	(554.8)
Household Lives in a Single Structure [yes=1]	-0.0205	-95.33	-0.0182	-57.71	-0.0414	-4,912	-0.103	-9,160
	(0.0573)	(230.8)	(0.0420)	(156.8)	(0.0376)	(3,984)	(0.168)	(6,589)
Roof Made of Tiles [yes=1]	0.0533	169.9	0.0385	128.4	-0.00713	-132.5	0.169	5,525*
	(0.0634)	(223.4)	(0.0282)	(113.4)	(0.0392)	(4,510)	(0.110)	(3,306)
Floor Made of Earth/Dung [yes=1]	0.0198	-116.7	-0.0325	-156.1	-0.0265	-4,418	-0.154	-11,667**
	(0.0570)	(218.3)	(0.0330)	(121.8)	(0.0371)	(3,930)	(0.0988)	(4,804)
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household Head Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Vet Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Animal Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (clusters)	786 (59)	786 (59)	685+ (50)	685+ (50)	647++ (49)	647++ (49)	786 (59)	768
Outcome mean for untrained HHs	0.250	241.1	0.109	56.36	0.125	2100	1.1775	19863.1

Notes: *** denotes significance at 1%, ** at 5%, and * at 10% level. The dependent variable across columns changes. Specifications related to whether any milk is produced, whether any earnings are generated from daily milk production, and whether any earnings are generated from milk production in the last month (Columns 1a, 2a, 3a) are estimated by probit models, where marginal impacts are reported. Specifications related to the value of total daily milk production, earnings from daily milk production and earnings from milk production in the last month (Columns 1b, 2b, 3b) are estimated by tobit models. The smaller sample sizes in some columns is due to some households not selling any of their milk. Standard errors are in parentheses that allow for clustering by cell. Survey weights are used throughout. All columns control for the following covariates in addition to the indicator of whether training is received with the Girinka cow: a complete series of sector dummies, characteristics of the Girinka cow received (breed, year cow was received, indicator whether it was a pass-on, whether it was bundled with medicines or other inputs), information on the household head (age, gender, education level dummies for primary and secondary schooling, a dummy variable for whether the main occupation of the household head is in farming), household characteristics (number of household members, a series of controls for the demographic composition of the household, the type of dwelling, type of roof and floor), information received from sector vets proxying for accessibility (number of minutes to reach the cell, whether the vet reaches the cell by walking there, an interaction of the two, and the number of days passed since the sector vet visited the cell). + The drop in sample size is due to households that do not sell any of their milk. ++ The additional drop in sample size in the per animal regressions is due to missing information on the number of animals the farm owns.

Table 5: The Provision of Training and Herd Size and Asset Accumulation

Standard Errors Clustered by Cell
OLS Regressions

	(1) Herd Size	(2) Cows Born	(3) Cows Purchased	(4) Cows Sold	(5) Cows Died	(6) Assets
Training Received with Girinka Cow [yes=1]	0.0653	0.136*	-0.0110	0.0959***	0.0106	0.269**
	(0.0657)	(0.0754)	(0.0441)	(0.0352)	(0.0214)	(0.118)
Household Head has Some Primary Education [yes=1]	0.0187	-0.00193	0.0840**	0.0312	0.0227	0.280**
	(0.0604)	(0.0706)	(0.0338)	(0.0425)	(0.0241)	(0.123)
Household Head has Some Secondary Education [yes=1]	-0.0972	-0.229	0.119	-0.0749	0.0196	0.867***
	(0.114)	(0.250)	(0.0801)	(0.0791)	(0.0471)	(0.209)
Number of Assets Owned Before Girinka Cow Received	-0.00118	0.00435	-0.00197	0.00622	0.00309	-0.0581
	(0.0110)	(0.0145)	(0.00585)	(0.00990)	(0.00541)	(0.0424)
Household Lives in a Single Structure [yes=1]	0.00735	-0.0853	0.0475	-0.0980	0.00413	-0.437*
	(0.157)	(0.119)	(0.0542)	(0.0731)	(0.0382)	(0.236)
Roof Made of Tiles [yes=1]	0.0901	0.0283	0.0129	-0.0202	-0.00898	0.299
	(0.0760)	(0.0863)	(0.0499)	(0.0328)	(0.0297)	(0.194)
Floor Made of Earth/Dung [yes=1]	-0.106	-0.303**	-0.0990	-0.0953**	-0.0470	-1.180***
	(0.0940)	(0.116)	(0.0752)	(0.0466)	(0.0365)	(0.212)
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Household Head Controls	Yes	Yes	Yes	Yes	Yes	Yes
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sector Vet Controls	Yes	Yes	Yes	Yes	Yes	Yes
Animal Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations (clusters)	785 (59)	785 (59)	785 (59)	785 (59)	785 (59)	786 (59)
Outcome mean for untrained HHs	1.3376	0.8984	0.1597	0.1543	0.0653	3.217

Notes: *** denotes significance at 1%, ** at 5%, and * at 10% level. The dependent variable across columns changes. All specifications are estimated using OLS regression models. Standard errors are in parentheses that allow for clustering by cell. Survey weights are used throughout. All columns control for the following covariates in addition to the indicator of whether training is received with the Girinka cow: a complete series of sector dummies, characteristics of the Girinka cow received (breed, year cow was received, indicator whether it was a pass-on, whether it was bundled with medicines or other inputs), information on the household head (age, gender, education level dummies for primary and secondary schooling, a dummy variable for whether the main occupation of the household head is in farming), household characteristics (number of household members, a series of controls for the demographic composition of the household, the type of dwelling, type of roof and floor), information received from sector vets proxying for accessibility (number of minutes to reach the cell, whether the vet reaches the cell by walking there, an interaction of the two, and the number of days passed since the sector vet visited the cell).

Table 6: Types of Training

Standard Errors Clustered by Cell

	(1) Milk Produced?	(2) Amount of Milk Produced	(3) Earnings from Daily Milk Production	(4) Cows Sold	(5) Assets
	Probit	Tobit	Tobit	OLS	OLS
Training Received with Girinka Cow [yes=1]	0.139**	1.374*	330.2**	0.0562	0.588**
	(0.0616)	(0.766)	(135.6)	(0.0415)	(0.231)
Training Receive Later from Sector Vet [yes=1]	0.00246	0.293	20.96	0.0848*	0.165
	(0.0454)	(0.546)	(142.8)	(0.0477)	(0.323)
Household received Other Inputs With Girinka Cow	-0.0320	0.550	91.76	0.0385	-0.286
(feed, loan, medicines) [yes=1]	(0.0546)	(0.848)	(141.6)	(0.0607)	(0.326)
Sector Dummies	Yes	Yes	Yes	Yes	Yes
Household Head Controls	Yes	Yes	Yes	Yes	Yes
Household Controls	Yes	Yes	Yes	Yes	Yes
Sector Vet Controls	Yes	Yes	Yes	Yes	Yes
Animal Controls	Yes	Yes	Yes	Yes	Yes
Observations (clusters)	786 (59)	786 (59)	786 (59)	786 (59)	786 (59)
Outcome mean for untrained HHs	0.250	0.909	0.109	0.1543	3.217

Notes: *** denotes significance at 1%, ** at 5%, and * at 10% level. The dependent variable across columns changes. The specification related to whether any milk is produced (Column 1a) is estimated by a probit model, where marginal impacts are reported. Specifications related to the amount or value of total daily milk production (Columns 2 and 3) are estimated by tobit models. The specifications related to the number of cows sold or assets owned (Columns 4 and 5) are estimated using OLS regression models. Standard errors are in parentheses that allow for clustering by cell. Survey weights are used throughout. All columns control for the following covariates in addition to the indicator of whether training is received with the Girinka cow: an dummy variable for whether any training is received from a sector vet after the Girinka cow transfer, a complete series of sector dummies, characteristics of the Girinka cow received (breed, year cow was received, indicator whether it was a pass-on, whether it was bundled with medicines or other inputs), information on the household head (age, gender, education level dummies for primary and secondary schooling, a dummy variable for whether the main occupation of the household head is in farming), household characteristics (number of household members, a series of controls for the demographic composition of the household, the type of dwelling, type of roof and floor), information received from sector vets proxying for accessibility (number of minutes to reach the cell, whether the vet reaches the cell by walking there, an interaction of the two, and the number of days passed since the sector vet visited the cell).

Table A1: The Provision of Training and Types of Asset Accumulation
Standard Errors Clustered by Cell

	(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
	Number of Assets Owned	Cellphone Ownership?	Number of Cellphones Owned	Bicycle Ownership?	Number of Bicycles Owned	Stove Ownership?	Number of Stoves Owned	Mattress Ownership?	Number of Mattresses Owned
	Tobit	Probit	Tobit	Probit	Tobit	Probit	Tobit	Probit	Tobit
Training Received with Girinka Cow [yes=1]	0.269**	-0.0321	0.171	0.0538*	0.180	0.128***	0.322***	0.0206	0.192**
	(0.118)	(0.0488)	(0.111)	(0.0281)	(0.118)	(0.0431)	(0.100)	(0.0527)	(0.0883)
Household Head has Some Primary Education [yes=1]	0.280**	0.209***	0.367***	-0.000625	-0.00932	0.0118	0.0485	0.109**	0.208**
	(0.123)	(0.0530)	(0.135)	(0.0305)	(0.120)	(0.0480)	(0.0944)	(0.0476)	(0.101)
Household Head has Some Secondary Education [yes=1]	0.867***	0.502***	0.877***	0.222***	0.228	-0.0558	-0.0123	0.276***	0.545***
	(0.209)	(0.0353)	(0.217)	(0.0860)	(0.167)	(0.0802)	(0.160)	(0.0546)	(0.172)
Number of Assets Owned Before Girinka Cow Received	-0.0581	0.0749***	-0.00343	0.0256***	0.0108	0.0503***	-0.0310	0.112***	-0.0183
	(0.0424)	(0.0117)	(0.0298)	(0.00519)	(0.0160)	(0.0107)	(0.0273)	(0.0112)	(0.0204)
Household Lives in a Single Structure [yes=1]	-0.437*	-0.0289	-0.435**	-0.120*	-0.294*	-0.146*	-0.183	-0.170*	-0.370**
	(0.236)	(0.0849)	(0.216)	(0.0616)	(0.157)	(0.0763)	(0.143)	(0.0872)	(0.153)
Roof Made of Tiles [yes=1]	0.299	0.167**	0.342**	0.0387	0.370**	0.166**	0.0681	0.00328	0.0469
	(0.194)	(0.0781)	(0.166)	(0.0405)	(0.180)	(0.0671)	(0.149)	(0.0625)	(0.144)
Floor Made of Earth/Dung [yes=1]	-1.180***	-0.354***	-0.705***	-0.0116	-0.0919	-0.0599	-0.432**	-0.225***	-0.410***
	(0.212)	(0.0801)	(0.170)	(0.0385)	(0.107)	(0.0948)	(0.179)	(0.0836)	(0.149)
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household Head Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Vet Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Animal Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (clusters)	786 (59)	786 (59)	786 (59)	700 (53)	700 (53)	760 (58)	760 (58)	786 (59)	786 (59)
Outcome mean for untrained HHs	3.217	0.473	0.607	0.170	0.169	0.277	0.308	0.498	0.835

Notes: *** denotes significance at 1%, ** at 5%, and * at 10% level. The dependent variable across columns changes. Specifications related to the number of assets of a given type is owned are estimated using a tobit model (Columns 1, 2b, 3b, 4b, 5b). Specifications related to whether an asset is owned are estimated by probit models, where marginal effects are reported (Columns 2a, 3a, 4a, 5a). Standard errors are in parentheses that allow for clustering by cell. Survey weights are used throughout. All columns control for the following covariates in addition to the indicator of whether training is received with the Girinka cow: an dummy variable for whether any training is received from a sector vet after the Girinka cow transfer, a complete series of sector dummies, characteristics of the Girinka cow received (breed, year cow was received, indicator whether it was a pass-on, whether it was bundled with medicines or other inputs), information on the household head (age, gender, education level dummies for primary and secondary schooling, a dummy variable for whether the main occupation of the household head is in farming), household characteristics (number of household members, a series of controls for the demographic composition of the household, the type of dwelling, type of roof and floor), information received from sector vets proxying for accessibility (number of minutes to reach the cell, whether the vet reaches the cell by walking there, an interaction of the two, and the number of days passed since the sector vet visited the cell).

Figure 1A: The Share of Households in a Cell That Receive Training With Their Girinka Cow

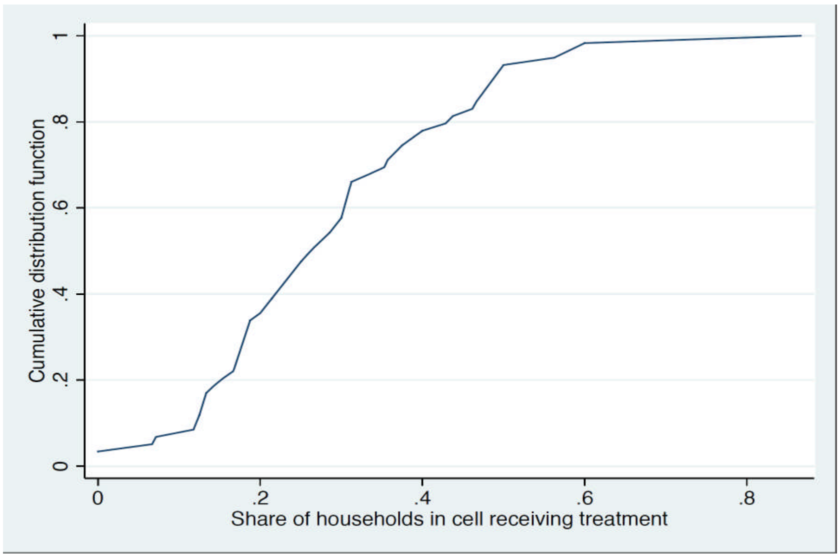


Figure 1B: Scatterplot of the Share of Households That Receive Training With Their Girinka Cow Against the Total Number of Girinka Cows Distributed in the Cell

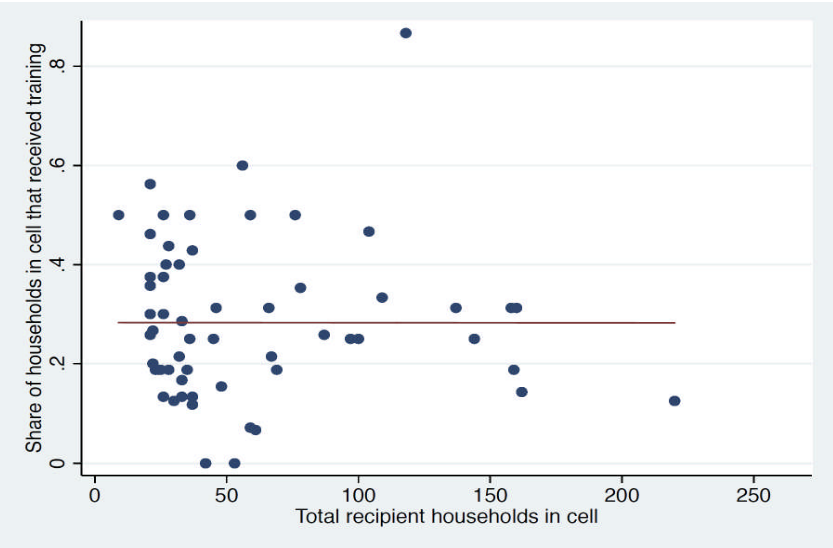
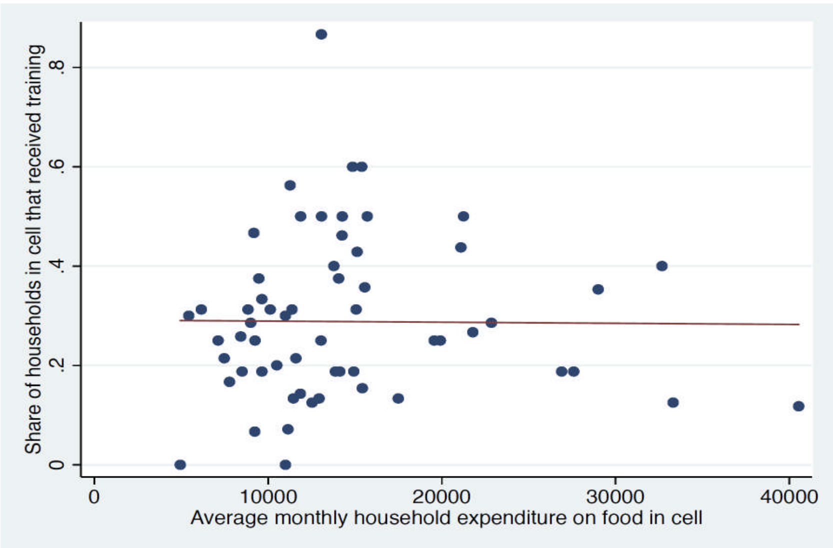


Figure 1C: Scatterplot of the Share of Households That Receive Training With Their Girinka Cow Against the Average Monthly Household Expenditure in the Cell



Notes: The total number of recipient households in each cell is calculated from the sampling frame as described in the methodology section. A fitted regression line is shown in Figures 1B and 1C: neither slope coefficient is significantly different from zero at conventional levels. All Figures aree all at the cell level, and all are unweighted.

Figure 2: Impacts of Training on Milk Production by Year the Girinka Cow was Received

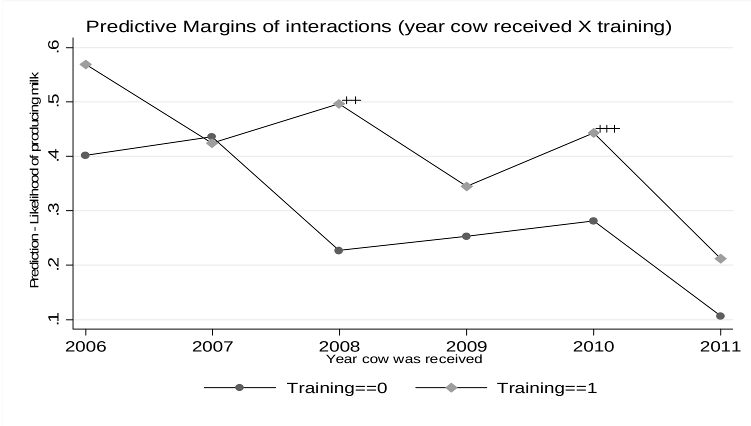


Figure 3: Impacts of Training on Amount of Milk Produced by Year the Girinka Cow was Received

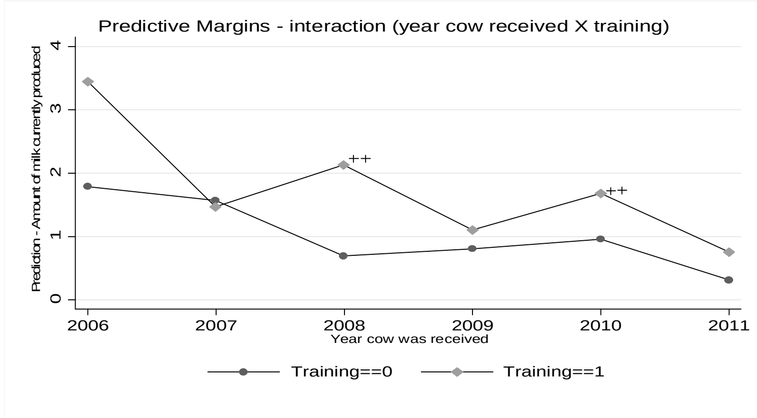


Figure 4: Impacts of Training on Current Income from Milk Selling by Year the Girinka Cow was Received

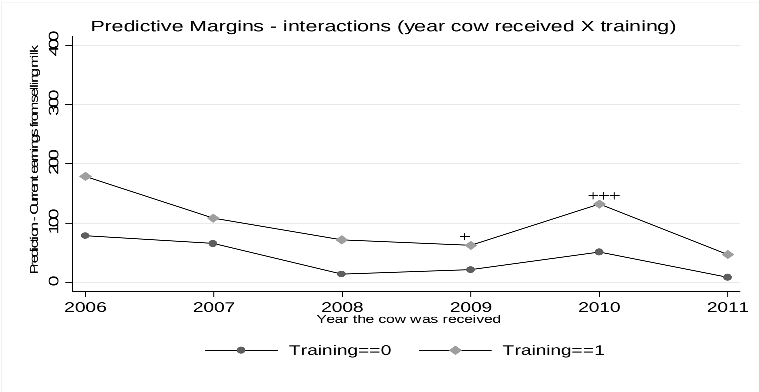
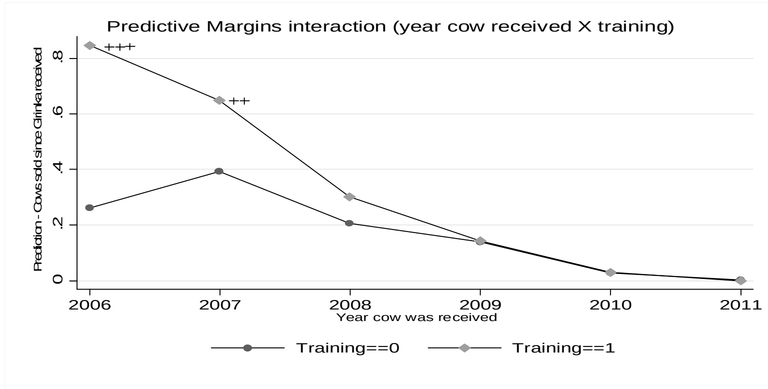


Figure 5: Impacts of Training on Number of Cows Sold Since the Girinka Cow was Received by Year it was Received



Notes: +++ denotes significance at 1%, ++ at 5%, and + at 10% level. Each figure considers a different outcome and plots the predicted probabilities of series of interactions between the year of transfer and the training indicator. Results in figure one are obtained through a linear specification, and Figures 3 to 5 using tobit specifications. Standard errors are in parentheses that allow for clustering by cell. Survey weights are used throughout. All estimations control for the following covariates in addition to the interaction terms: a complete series of sector dummies, characteristics of the Girinka cow received (breed, year cow was received, indicator whether it was a pass-on, whether it was bundled with medicines or other inputs), information on the household head (age, gender, education level dummies for primary and secondary schooling, a dummy variable for whether the main occupation of the household head is in farming), household characteristics (number of household members, a series of controls for the demographic composition of the household, the type of dwelling, type of roof and floor), information received from sector vets proxying for accessibility (number of minutes to reach the cell, whether the vet reaches the cell by walking there, an interaction of the two, and the number of days passed since the sector vet visited the cell).