

Competitiveness of pastoral livestock production and
sea buckthorn farming in Mongolia:
Application of Policy Analysis Matrix

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Summary

This dissertation deals with two issues related to the competitiveness of the Mongolian agricultural sector: pastoral livestock production and sea buckthorn farming.

The pastoral livestock sector plays a vital role for rural development in Mongolia. Pastureland is a public good and herders are free to let their livestock graze. The number of livestock heavily influences sectoral development. Increasing numbers of goats causes pastureland degradation due to goats' grazing habits. Nonetheless, nomadic herders hold more goats than other types of livestock because cashmere is the basis for their cash income. However, it is unconfirmed whether goats are the most competitive/profitable animal compared with sheep, cattle, horse and camel. The aim of this study is to analyse the competitiveness of livestock production in Mongolia using the Policy Analysis Matrix approach. The approach takes into account private and social revenues and costs to analyse the competitiveness of production. The literature to date has not yet worked with primary, disaggregated, individual farm data for nomadic pastoral livestock husbandry in Mongolia. We use two years of panel data from 176 herder households in *Bulgan* County, *Khovd* province of Mongolia, and analyse five types of meat, milk and hides, and four types of hair/wool. We conclude that the estimated cost of pastureland has little effect on the competitiveness of livestock production. Our results show that pastoral livestock production in Mongolia is privately and socially competitive. Cattle is the most competitive livestock type from both the private and social perspectives, not the goat as the current management implies, in particular because cattle require less labour than goats. The most competitive households have larger numbers of livestock, lower mortality rates in *Dzud* disaster, cattle based production, and less mobility costs than the least competitive households.

Sea buckthorn (*Hippophae Rhamnoides*) provides multiple products that are very nutritious and healthy. Plus, sea buckthorn mitigates against desertification. The most valuable output is oil, extracted from the pulp and seeds of the sea buckthorn berry. Scientists in the fields of ecology, botany, environmental sciences, food and medicine have studied sea buckthorn. However, there is no solid economic and market analysis for sea buckthorn, which traces back to a lack of data. We analyse the private and social competitiveness of sea buckthorn farming of 21 households in *Bulgan* county of *Khovd* province in Mongolia. We confirm that half of the interviewed sea buckthorn berry farmers are competitive, yet their level of competitiveness is not very high. This could be caused by lack of experience in sea buckthorn farming. Interestingly, the private competitiveness level is lower than the social one. Output prices are high due to government support policies; however input prices are also and even more distorted. Consequently, producers display low levels of private profitability. Hence, to improve the private competitiveness, the policies should focus towards decreasing the costs of inputs of the production system. The level of competitiveness of sea buckthorn farming has increased from 2012 to 2013, which might be due to the government's "Sea Buckthorn National Programme". According to interviewed producers, the most serious challenge facing sea buckthorn production is lack of finance, which is also evidenced that more than one third of the total cost of the farming is composed of investment costs.

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Acronyms

| | |
|--------|---|
| crf – | Capital recovery factor |
| DRC – | Domestic Resource Cost |
| FAO – | Food and Agriculture Organization of the United Nations |
| GDP – | Gross Domestic Product |
| HH – | Herder household(s) |
| MNT – | Mongolian National Tugrik (currency unit) |
| MOFA – | Ministry of Food and Agriculture of Mongolia |
| NSOM – | National Statistical Office of Mongolia |
| OECD – | Organisation for Economic Co-operation and Development |
| PAM – | Policy Analysis Matrix |
| PCB – | Private Cost Benefit |
| PCR – | Private |
| ppd – | per person per day |
| ppm – | per person per month |
| PTF – | Proportion to total number of farmers |
| PTOV – | Proportion to total output value |
| PTP – | Proportion to total production volume |
| RMB – | Renminbi (official currency unit of China) |
| SBNP – | Sea Buckthorn National Programme |
| SCB – | Social Cost Benefit |
| SCF – | Standard Conversion Factor |
| SHU – | Sheep Unit |
| STD – | Standard Deviation |
| TSU – | Tax Sheep Unit |
| UN – | United Nations |
| USD – | United States Dollar |

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1. INTRODUCTION

Mongolia is located between Russia and China in Central Asia. It has three million inhabitants, with one and half million square km land, and ranks as the nineteenth largest country in the world according to land mass. Mongolia is rich in biodiversity, and has extreme climatic conditions. The country is dryland and has a low level of precipitation, and temperatures sink to -40° Celsius in winter and reach $+40^{\circ}$ Celsius in the summer. Twenty-two percent of the people are poor (NSOM, 2015d), and the country is classified as an “upper middle” income country (World Bank, 2015a, 2015b).

The agricultural sector remains as an important economic sector while a mining ‘boom’ in Mongolia is currently diminishing due to falling global prices for natural resources. The livestock sector dominates Mongolian agriculture. The livestock sector is nomadic and pastoralist based, and considerably dependant on natural capital, especially pastureland. Nomadism and pastoralism refers to the continual moving within and between seasonal camp(s) where herding communities graze their livestock on the pastureland. The Mongolian livestock sector relies on the production of five types of livestock, including goats (42.3%), sheep (44.7%), cattle (6.6%), horses (5.8%) and camels (0.7%) (NSOM, 2015c). In 2014, Mongolia had 52 million livestock (NSOM, 2015c). The main export outputs of the Mongolian livestock sector are cashmere, hides and hair of livestock.

Sea buckthorn (*Hippophae Rhamnoides*) is a deciduous shrub that yields berries, and naturally occurring in Asia and Europe. The berry of sea buckthorn is highly nutritious and rich in vitamins (Li and Shroeder, 1996, p. 376). The sea buckthorn berry is one of the healthiest fruits (Zeb, 2004), and the plant itself helps to stop desertification thanks to its extensive roots system (Heinze and Fiedler, 1981; Li and Shroeder, 1996).

This dissertation focuses on the competitiveness of pastoral livestock production and sea buckthorn farming in Mongolia. To date, there is no competitiveness analysis for pastoral livestock production, which compares different livestock outputs and types, given that a single livestock produces multiple outputs. Hence, the policies for fostering the agricultural development in rural areas are vague until the open questions are answered by scientific evidence. Examples of those open questions are: ‘What is the level of competitiveness for livestock (sea buckthorn) production in Mongolia? Does the level of competitiveness differ depending on types of outputs, livestock and households? What are the determinants of competitive households compared to non-competitive households? What are the policy options that may improve competitiveness level?’

‘Competitiveness’ has a broad meaning and therefore there is no universally accepted definition (Hatzichronoglou, 1996; Sharples, 1990). However, the general consensus among economists regarding the definition of competitiveness may be the definition of OECD reported by Hatzichronoglou (1996, p. 20), which is “*the ability of companies, industries, regions, nations or supranational regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis*”.

Several methodologies for estimating competitiveness have been developed (see more in Hatzichronoglou, 1996; Latruffe, 2010; von Cramon-Taubadel and Nivyeviskyi, 2008 etc.). We measure the competitiveness of the production system by two types of ratios, including private cost benefit (PCB)

and social cost benefit (SCB) ratios, using the Policy Analysis Matrix (PAM) approach developed by Monke and Pearson (1989). PCB accounts for the ratio between total cost and income based on the private price that the product is traded at in the domestic market. If the private income can cover the private cost of the production then the production system is considered to be privately competitive. SCB indicates the ratio between total cost and income based on the social price that the product is traded at on the international market. If the social income can cover the social cost of the production then the production system is socially competitive.

We use primary data of 176 randomly selected herder households and 21 sea buckthorn farmer households from *Bulgan* county in *Khovd* province in Mongolia. The data was collected in the field from 2012 to 2014. Secondary data obtained from governmental and international organizations, and the existing literature are also used to estimate competitiveness levels. The considered outputs are five types of meat, hide, and milk and four types of hair/wool products from goats, sheep, cattle, horses and camels, and sea buckthorn berry. In order to compare the competitiveness level between livestock types, we aggregated the incomes and costs of each output for each livestock type. Furthermore, we aggregated the total incomes and costs of all types of livestock to see the competitiveness level by each household level.

We conclude that the pastoral livestock production system in Mongolia is competitive; and for sea buckthorn, the level of competitiveness is not high. Goat (cashmere) is not the most competitive livestock (output); instead cattle (cow milk) is. We also find that the social cost of pastureland for livestock production has only minor effects on competitiveness, although most of researchers claim that pastureland degradation is a serious issue. However, we acknowledge the limitation of this study in that we assumed the rate of pastureland cost based on the livestock tax law proposal by Government of Mongolia (2014b), which may not accurately reflect the costs of pasture degradation. Secondly, the study is conducted right after the *Dzud* 2010 (natural winter disaster that causes livestock death due to starvation, heavy snow and frost), in which about half of the livestock died in *Bulgan* and therefore herd sizes were reduced, thus reducing pressure on pastureland. In the competitiveness of sea buckthorn study, we confirm that half of the interviewed sea buckthorn berry farmers are competitive, yet their level of competitiveness is not very high. This could be caused by lack of experience in sea buckthorn farming, and high fixed input costs, especially investment costs. The level of competitiveness of sea buckthorn farming has increased from 2012 to 2013, which might be due to the government's "Sea buckthorn National Programme". According to interviews with sea buckthorn producers, the most serious challenge is lack of finance, which is also evidenced as more than one third of the total cost of sea buckthorn farming is composed of investment costs.

The remainder of the dissertation is structured as follows. Chapter 2 relays the first essay on the competitiveness analysis of pastoral livestock production. Chapter 3 includes the second essay on the competitiveness analysis of sea buckthorn. Chapter 4 follows with the main results, discussion, policy implications, and further research development aspects. Finally, I end with conclusions in Chapter 5.

2. ESSAY 1: “THE COMPETITIVENESS OF PASTORAL LIVESTOCK PRODUCTION IN MONGOLIA: APPLICATION OF POLICY ANALYSIS MATRIX”

2.1. Abstract

The pastoral livestock sector plays a vital role for rural development in Mongolia. Pastureland is a public good and herders are free to let their livestock graze. The number of livestock heavily influences sectoral development. Increasing numbers of goats causes pastureland degradation due to goats' grazing habits. Nonetheless, nomadic herders hold more goats than other types of livestock because cashmere is the basis for their cash income. However, it is unconfirmed whether goats are the most competitive/profitable animal compared with sheep, cattle, horse and camel. The aim of this study is to analyse the competitiveness of livestock production in Mongolia using the Policy Analysis Matrix approach. The approach takes into account private and social revenues and costs to analyse the competitiveness of production. The literature to date has not yet worked with primary, disaggregated, individual farm data for nomadic pastoral livestock husbandry in Mongolia. We use two years of panel data from 176 herder households in *Bulgan* County, *Khovd* province of Mongolia, and analyse five types of meat, milk and hides, and four types of hair/wool. We conclude that the estimated cost of pastureland has little effect on the competitiveness of livestock production. Our results show that pastoral livestock production in Mongolia is privately and socially competitive. Cattle is the most competitive livestock type from both the private and social perspectives, not the goat as the current management implies, in particular because cattle require less labour than goats. The most competitive households have larger numbers of livestock, lower mortality rates in *Dzud* disaster, cattle based production, and less mobility costs than the least competitive households.

Keywords: Pastoral livestock, production, herder households, private and social competitiveness, income, cost, price

2.2. Introduction

Mongolia has one of the largest pastoralist populations as a share of its total population. The number of livestock is increasing; the National Statistical Office of Mongolia (NSOM, 2015c) reported 25.9 million livestock in 1990, which increased to 51.9 million in 2014. The pastoral livestock sector is dependent on natural and climatic conditions such as precipitation, temperature and pasture biomass, and it is vulnerable to a natural disaster (*Dzud*). *Dzud* is a combination of heavy snow, strong storms, and extremely low temperatures that limits livestock mobility and access to grazing area and biomass resulting in animal death from starvation and cold (UN Mongolia Country Team, 2010).

Mongolian nomadic herder households (HH) use pastureland, the most precious input, free of charge for livestock production. Herders keep livestock for their private benefit and they are aware that environmental protection is important (Fernández-Giménez, 2002). HH tend to increase livestock numbers, especially goats. The consensus among researchers is that increasing herd sizes lead to pastureland degradation in Mongolia (Dietz et al., 2005; Fernández-Giménez, 2002; Green Gold Project, 2015; Lise et al., 2006; Maekawa, 2013)

Herders end up competing for pastureland as the number of livestock exceeds the potential carrying capacity of the pastureland. The traditional composition of the five types of livestock has become imbalanced since the start of the economic transition in the 1990s. In 1990, goats accounted for 19.8% of the total livestock herd; in 2014 it was 42.3% (NSOM, 2015c).

Goats are raised to produce cashmere (Berger et al., 2013; Lise et al., 2006). Goat cashmere is an important export commodity, and Mongolia is the second largest cashmere exporter in the world (Lecraw et al., 2005). Cashmere is also the main source of cash income for most of the herders in Mongolia (Lecraw et al., 2005; Lkhagvadorj et al., 2013). This is possible, partially because cashmere is easy to store and transport, and it receives a high price on the market (Lkhagvadorj et al., 2013; Maekawa, 2013). High transportation costs limit the ability of pastoral herders to supply central markets with other types of livestock outputs such as meat and milk (McPeak and Barrett, 2001).

The scientific community debates whether pastureland degradation is due to the increasing share of goats as a portion of total livestock. One argument is that the degradation is more likely caused by inconsistent natural precipitation and natural soil formation processes (Stumpp et al., 2005). On the other hand, goats have a wider dietary spectrum than sheep, grazing both grasses and forbs in a shrub free environment, which is the case on the pastures in *Bulgan* (Animut et al., 2005; World Bank, 2002). Based on Animut et al. (2005), it can be concluded that when the forage becomes limited, the goats will graze down the vegetation to a larger extent than sheep, because goats prefer a wider range of plants. Berger et al. (2013) find that even the survival of endangered wild large mammals is affected by the increased grazing pressure from goats in Central Asia.

The Government of Mongolia already tried to reduce the number of goats by imposing higher tax rates for goats. Between 2007 and 2009, HH paid taxes per head of livestock as stipulated by the Personal Income Tax Law of Mongolia (Parliament of Mongolia, 2006). According to the law, goats were taxed 1.5 times more than a sheep; even though forage requirements of goats are 10% lower than sheep (1 goat equals to 0.9 sheep unit, FAO, 2006). Nonetheless, the Mongolian parliament stopped levying this tax in mid-2009 due to pressure from herder communities. Parliament members who voted to end the tax justify their decision based on the economic downturn following the global financial recession in 2008 (Erdenesaikhan and Onon, 2012).

Nomadic pastoralism is an ancient but under-researched way of life from an economic perspective. Therefore, it is interesting to study whether it is an economically sustainable system. Based on their estimation, McGahey et al. (2014) reported that about 500 million people are pastoralists worldwide. Furthermore, Rass (2006) estimated the number of pastoralists at 120 million, of which 35-90 million are considered poor.

There are very few studies focused on the competitiveness of livestock production in Mongolia, and none of them focus on comparing private and social competitiveness of the five types of Mongolian livestock products. Lkhamsuren (2004) describes the competitiveness of agricultural products in the Asian Productivity Report. She reports that although the number of livestock in Mongolia is high, most livestock products are not competitive on international markets, except cashmere. For example, meat is not competitive because Mongolia exports only small numbers of livestock meat due to the international

hygienic standards. On the contrary, Everett (2005) notes that beef production of Mongolia is competitive on international market when the advantages of ‘environmentally clean’ and ‘free range’ are taken into account. However international standards and strict import bans for countries with histories of livestock diseases restrict Mongolia’s ability to export meat (Everett, 2005). Everett adds that raw materials, for example hide are also not competitive in Mongolia because of low quality, which reduces export prices. This is connected to the fact that Mongolia does not have sufficient capacity to process skin and hide (Everett, 2005). Thus, Mongolia exports these products to China as unprocessed material for low prices.

Research questions addressed in this study are ‘is pastoral livestock production in Mongolia competitive?’, and ‘what is the most competitive type of livestock?’, and ‘what are the determinants of the most and least competitive HH?’. The aim of this study is to analyse the private and social competitiveness of livestock production in Mongolia. The study area for analysis is *Bulgan* county of *Khovd* province, western Mongolia, which borders *Qinghe* County, *Xinjiang* province, China. *Bulgan* county is about 1,500 km far from capital city, and about 250 km from *Khovd* city. In total, 2,153 households live in *Bulgan* county and 943 of them were HH in 2012 (*Bulgan* County Administration Office, 2012). According to statistics, the total number of livestock in *Bulgan* county in 2012 was 154 thousand heads (goat 64%, sheep 21%, cattle 10%, horse 4%, and camel 1%; Statistics Office of *Khovd*, 2013). *Bulgan* was one of the most affected counties by *Dzud* in winter 2009/2010. The number of livestock lost reached 95 thousand, which was 40% of total number of livestock at the time (Statistics Office of *Khovd*, 2011, Appendix Figure 1). According to our interviews with HH, the 2010 *Dzud* was the worst in the study area in the last 40-50 years and dramatically affected the livelihoods. Experience of herding had almost no mitigating effect on livestock loss due to *Dzud* 2010 in Western Mongolia, including *Bulgan* county (Middleton et al., 2014).

We use the Policy Analysis Matrix (PAM) approach for competitiveness analysis developed by Monke and Pearson (1989), because it has been used to examine many production systems in different countries. The study sample size is 176 HH for two year balanced panel data. We analysed meat, milk and hide of 5 types of livestock (goat, sheep, cattle, horse and camel), and 4 types of hair (excluding cattle hair), for a total of 19 types of outputs. The interviews included questions on inputs, outputs, and prices.

The estimated social cost of pastureland has little effect on the competitiveness of livestock production; however further research is needed for valuing the land. The key input for livestock production is labour. We conclude that pastoral livestock husbandry is privately and socially competitive, and that cattle is the most competitive livestock type in Mongolia. Goat (cashmere) is not the highest profit earning livestock type (output). The most competitive HH have smaller livestock mortality rates during *Dzud*, and a higher number of livestock. The competitive HH are also more focused on cattle production and incur fewer mobility costs compared to the least competitive HH.

2.3. Method

‘Competitiveness’ has a broad meaning and therefore there is no broadly universally accepted definition (Hatzichronoglou, 1996; Sharples, 1990). However, the general consensus among economists regarding the definition of competitiveness may be the definition of OECD reported by Hatzichronoglou (1996, p. 20), which is “*the ability of companies, industries, regions, nations or supranational regions to*

generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis”.

The PAM approach is a quantitative method to estimate profitability and competitiveness of a given production system. PAM starts with the profitability of production system in the private perspective. The private profit (D) is a result of revenue (A) minus costs of tradable inputs (B) and domestic factors (C) at domestic market prices (Monke and Pearson, 1989, Appendix Table 1). A production system (or firm) is profitable if D is positive.

However, domestic market prices do not illustrate the social benefit and cost of the production system, and other measurements are needed for social competitiveness. The formula remains the same, except that multiplying prices are social. Sometimes the social price is called as the shadow or economic price. Monke and Pearson (1989) suggest using export (import) prices as the social prices of exportable (importable) outputs and inputs. The idea is that if the output were to be sold on the international market the price the producer receives may be different from the domestic price. The implication for an output is that if the export or import price is higher than the domestic price, then the domestic consumers enjoy the cheaper price, but the producers suffer from the lower price. This may be due to government subsidy policies for consumers or taxes for producers. The inverse case is when the producers enjoy the higher price, due to government subsidy or import ban, but then the consumers pay high prices.

Divergence between private and social prices exists when market failure takes place. Markets fail mostly due to market power, externalities or distorting policies (Monke and Pearson, 1989). Policies sometimes distort the markets (distorting policies), but can also fix market failures (efficient policies). PAM examines the effect of policies on agricultural production. If the policy decreases the divergence between private and social profitability then the policy is efficient (Monke and Pearson, 1989). In other words, efficient policies offset market failure. On the other hand, if the policy increases the divergence, then the policy is called distorting.

In the last row of PAM, the divergences of revenue (I), of tradable input costs (J), of domestic factor cost (K), and profit (L) are calculated. Divergences are the gap between revenue and costs multiplied by private and social prices. The bigger the divergences implies greater the market failure and stronger distorting policies, resulting in an inefficient the market outcome.

The divergences are numbers that are difficult to compare across different commodity systems, because the magnitudes and units of production and prices differ. Hence, analysts usually derive several ratios from the PAM for comparison of production systems.

Private cost ratio, $PCR=C/(A-B)$, implies ratio between cost of domestic factor and value added, in private prices (Monke and Pearson, 1989). Private firms try to minimize PCR by reducing B and C to maximize their profit. Domestic resource cost ratio, $DRC=G/(E-F)$, compares opportunity cost of domestic factors with its value added. It measures comparative advantage of the commodity. If $0 < DRC < 1$, then the domestic production is competitive because value added per commodity can cover incurred social cost of domestic input and remains profitable compared to border price (Gorton and Davidova, 2001). If $0 > DRC > 1$, then production is not competitive.

Alternatively, researchers use private (PCB) and social (SCB) cost benefit ratios. PCB (SCB) shows the competitiveness of the commodity from a private (social) perspective. The ratio is the sum of costs of tradable inputs and domestic factors in private (social) prices divided by total revenue of the good in private (social) prices ($PCB=(B+C)/A$; $SCB=(F+G)/E$). PCB and SCB never fall below zero. Hence, the value of them between zero and one indicates that the commodity is competitive. In other words, the costs are less than the benefits. If the ratios are higher than one then the commodity is not competitive, based on the perspective.

The DRC is sensitive to many variable inputs, especially the choice of the reference or border price for domestic factors, and exchange rates and international prices. DRC is also discontinuous at zero, and is sensitive to categorization of inputs whether domestic or tradable (Masters and Winter-Nelson, 1995; Nivievskiy and von Cramon-Taubadel, 2009). Thus, in our analysis we use PCB and SCB ratios.

PAM analysis is subject to some limitations. For example, most PAM analysts use national averages to estimate costs and revenues of a production system. However, averages cannot illustrate the best or worst practices and cannot judge in terms of statistical inferences (Morrison and Balcombe, 2002; von Cramon-Taubadel and Nivyeviskyi, 2008, 2009). Morrison and Balcombe (2002) propose re-sampling the input and output data with the bootstrap methodology developed by Efron and Tibshirani (1998) to increase reliability. This method draws the distribution of main indicators of competitiveness of PAM. Statistical inference using the confidence interval and standard deviation of those indicators can then be carried out (Morrison and Balcombe, 2002; von Cramon-Taubadel and Nivyeviskyi, 2009). Due to unavailability of farm level and disaggregated data, most PAM researchers use aggregated data. We adapt the methodological innovation of von Cramon-Taubadel and Nivyeviskyi (2008) to estimate distributions of competitiveness indicators in our study.

In this paper, we used PCB and SCB ratios for measuring the competitiveness level for each output and each livestock type. We estimated total income and cost for each output per unit. For livestock type, we estimated income and cost per sheep unit (SHU; see Data description) by livestock type (calculation is made by aggregating total income and cost of each product and dividing by the number of that livestock type for that HH).

2.4. Data

2.4.1. Sampling and data collection

To select the HH, we used stratified random sampling method. Subcounty leaders provided the names of HH heads registered in the subcounties of *Bulgan* county. According to the unpublished civil registration book from the subcounties of *Bulgan* county, there were 2,153 households in *Bulgan* county, and 943 (44%) of them were HH as of June 13, 2012 (*Bulgan* County Administration Office, 2012). We stratified the HH by subcounties and location based on county centre or summer pasture¹.

¹ Location of HH is different in different seasons. Traditionally, HH move in every season. For example, in winter they stay with their livestock in winter camps located in a lower valley in *Bulgan*. In winter fences and shelters are prepared and livestock graze less on the pasture.

Table 1. Stratified and randomly selected 200 HH

| Subcounties | Total number of households | Herder households (% in total)* | Sample size (% in total)* | Sample size by location | |
|-----------------------|----------------------------|---------------------------------|---------------------------|-------------------------------|---------------------------------|
| | | | | In county centre (% by row)** | In summer pastures (% by row)** |
| <i>Bayangol</i> | 318 | 172 (18%) | 37 (18%) | 17 (46%) | 20 (54%) |
| <i>Bayansudal</i> | 366 | 275 (29%) | 58 (29%) | 38 (66%) | 20 (34%) |
| <i>Baitag</i> | 357 | 157 (17%) | 33 (17%) | 16 (48%) | 17 (52%) |
| <i>Alag Tolgoi</i> | 325 | 275 (29%) | 58 (29%) | 34 (59%) | 24 (41%) |
| <i>Dalt</i> | 386 | 37 (4%) | 8 (4%) | 6 (75%) | 2 (25%) |
| <i>Burenkhairkhan</i> | 401 | 27 (3%) | 6 (3%) | 4 (67%) | 2 (33%) |
| Total | 2153 | 943 (100%) | 200 (100%) | 115 (58%) | 85 (42%) |

Source: Authors' calculation, based on unpublished data reported by subcounty heads (*Bulgan* County Administration Office, 2012)

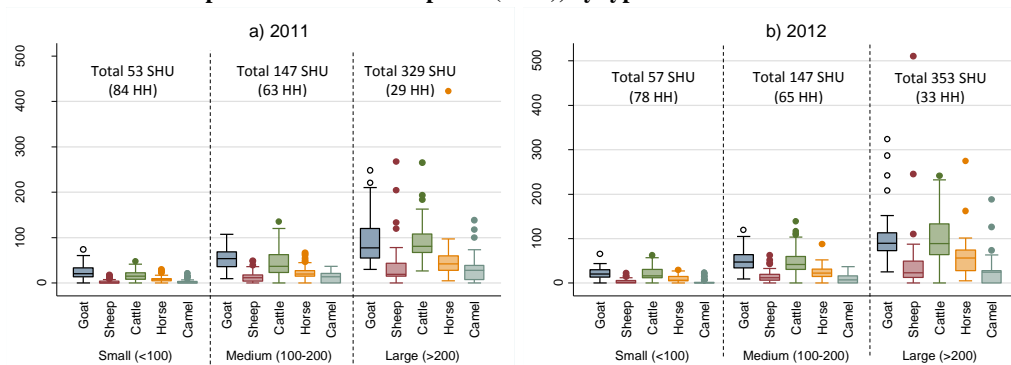
*Percentage in bracket is the proportion of HH in subcounties compared to total number of HH, which is used to stratify the sample by subcounties.

** Percentage in brackets shows the proportion of HH located in county centre or summer pasture compared to total HH. This is used to stratify the sample by location.

We used percentages of HH in the *Bulgan* county to stratify the sample by subcounties and location (Table 1). Using Microsoft Excel commands (RAND, SMALL, MATCH, INDEX), we selected 200 HH from the list of 943 HH in the 6 subcounties. Due to geographical constraints, we were able to survey 197 of the 200 selected HH on the summer pastures in 2012; we were able to re-interview 184 of them in 2013. We excluded 8 HH because their annual income was derived mostly from non-livestock activities. Consequently, this paper analyses two year (for 2011 and 2012) balanced panel data from 176 HH. The interviews in 2012 covered the livestock production activities for 2011; likewise, the interviews in 2013 covered 2012 activities. It is possible that some respondents erred on the side of caution and reported less income and livestock than they had, because some respondents presumed that the project would support the poor households after the survey. To limit this bias, we explained the research and purpose of the survey in detail before each interview began.

2.4.2. Data description

On average, one HH keeps 132 (146) SHU of livestock, including 47 (48) goats, 14 (16) sheep, 39 (47) cattle, 22 (24) horses and 11 (11) camels in 2011(2012)².

Figure 1. Number of livestock per household in sheep unit (SHU), by types

Source: Authors' estimation based on survey panel data of 176 HH

² FAO (2006) reports sheep unit, which is conversion coefficient for different type of livestock into one unit based on biological food consumption of each livestock in case of China. See more details from Appendix Table 2.

We categorized the HH based on livestock number: small, medium, and large livestock households according to the following thresholds: <100, 100-200, and >200 SHU. On average, a small household has about 53 (57), a medium 147 (147), a large 329 (353) SHU of livestock in 2011(2012) (Figure 1). The smaller the household, the higher the share of goats when comparing the small, 44% (37%), versus the large HH, 30% (30%), in 2011(2012) over total livestock.

We analysed 19 types of outputs to determine competitiveness; although, not all HH have all five types of livestock or produce all types of outputs. Furthermore, we determined competitiveness for the types of livestock and by household.

Table 2. Descriptive statistics of annual production per household

| Livestock type | Output | 2011 | | | 2012 | | | Change in mean (%)* |
|----------------|--------------------------|---------|---------|----------|---------|---------|----------|---------------------|
| | | Mean | ±STD | Max. | Mean | ±STD | Max. | |
| Goat | Meat (kg) ¹ | 276.4 | 163.0 | 1,188.4 | 306.8 | 168.3 | 1,290.9 | 11.0% |
| | Hide (unit) ² | 13.5 | 8.0 | 58.0 | 15.0 | 8.2 | 63.0 | 11.0% |
| | Milk (L) ³ | 394.3 | 520.2 | 2,825.0 | 243.6 | 431.9 | 2,360.0 | -38.2% |
| | Cashmere (kg) | 22.3 | 18.8 | 145.0 | 25.4 | 23.0 | 140.0 | 14.2% |
| Sheep | Meat (kg) | 95.8 | 259.9 | 3,216.0 | 81.2 | 136.8 | 1,072.0 | -15.3% |
| | Hide (unit) | 3.6 | 9.7 | 120.0 | 3.0 | 5.1 | 40.0 | -15.3% |
| | Milk (L) | 15.6 | 75.0 | 676.0 | 10.2 | 38.5 | 271.8 | -34.6% |
| | Wool (kg) | 22.9 | 83.4 | 1,000.0 | 24.0 | 89.5 | 1,100.0 | 4.8% |
| Cattle | Meat (kg) | 180.4 | 185.7 | 882.0 | 147.3 | 128.1 | 705.6 | -18.3% |
| | Hide (unit) | 1.0 | 1.1 | 5.0 | 0.8 | 0.7 | 4.0 | -18.3% |
| | Milk (L) | 1,623.0 | 1,871.9 | 11,597.0 | 1,876.3 | 2,382.4 | 16,197.0 | 15.6% |
| Horse | Meat (kg) | 32.4 | 78.2 | 475.5 | 31.1 | 62.8 | 158.5 | -4.2% |
| | Hide (unit) | 0.2 | 0.5 | 3.0 | 0.2 | 0.4 | 1.0 | -4.2% |
| | Milk (L) | 20.8 | 102.7 | 820.0 | 5.8 | 47.4 | 532.0 | -72.4% |
| | Hair (kg) | 2.6 | 11.6 | 150.0 | 2.2 | 5.0 | 40.0 | -13.2% |
| Camel | Meat (kg) | 16.1 | 65.7 | 282.8 | 4.8 | 36.7 | 282.8 | -70.0% |
| | Hide (unit) | 0.1 | 0.2 | 1.0 | 0.0 | 0.1 | 1.0 | -70.0% |
| | Milk (L) | 4.0 | 43.1 | 554.0 | 4.9 | 39.9 | 416.0 | 24.1% |
| | Wool (kg) | 7.0 | 17.4 | 150.0 | 6.9 | 24.3 | 300.0 | -2.2% |

Source: Authors' estimation based on survey panel data of 176 HH;

Note: * Change of mean of livestock production 2011-2012.

¹ Average meat output per animal (goat 20.49kg, sheep 26.8kg, cattle 176.4kg, horse 158.5kg, camel 282.8kg (Saipolda et al., 2010, pp. 149–158) is multiplied by number of slaughtered livestock³.

² Number of hides produced equals to number of livestock slaughtered - note that the change in mean is the same for meat and hide.

³ Estimated annual amount of milk produced

Goat and cattle production contribute the most to livelihoods of HH in *Bulgan* county. In meat and hide production, goat dominates, but cattle provide the most milk. The average HH produced 601.1 (571.2) kg meat, 18.3 (19.0) units of hides, 2,057.6 (2,140.8) litres milk and 54.74 kg of hair in 2011 (2012). From 2011 to 2012, goat meat, hide and cashmere, sheep wool, cow milk and camel milk production increased, but for the other outputs production decreased.

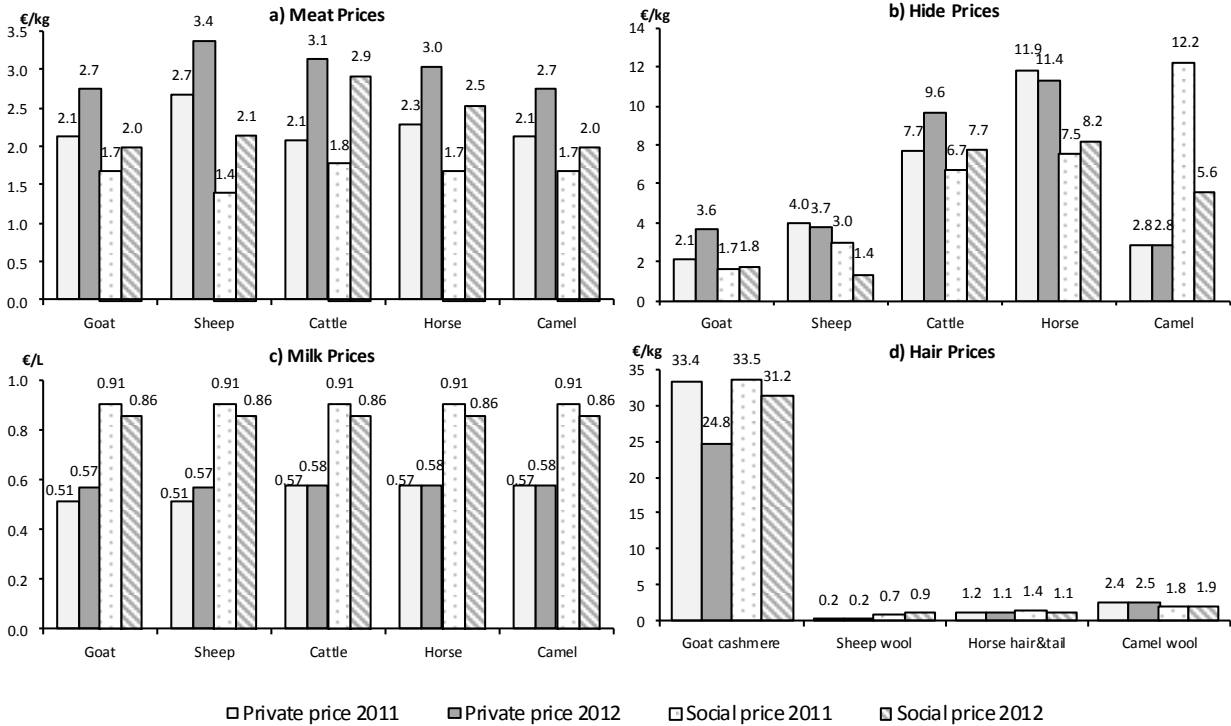
To determine private prices, interviewees cited the prices at which they sold the respective outputs. Where prices were missing we used unpublished price data of *Khovd* province from NSOM (2013). We used the social price of milk as the import price, and the rest of the prices are the export prices. The Custom Agency of Mongolia (2012) does not report the unit price of exported and imported goods,

³ WATERCOPE project members weighed 351 adult goats (46% male, 54% female) and 178 adult sheep (25% male, 75% female) in *Sunkhul* Lake summer pasture of *Bulgan* county, in July 2014. The average adult goat weighed 45.54 kg and sheep 49.92 kg.

although it reports the total amount in both physical volume and monetary amount. To estimate the unit price, we divided total monetary amount by volume (See Appendix 1). Note that, we adjusted the border prices to include transportation costs to *Bulgan* county; the transportation costs per Kg, approved by Ministry of Road and Transportation (2013), was subtracted from export prices for exportable outputs, and aggregated to import prices for importable outputs.

HH need capital, land and labour for production. According to the PAM approach, the inputs are divided into two categories: tradable and non-tradable (Monke and Pearson, 1989). We identified 32 types of inputs. We treat all the costs as non-tradable inputs, except vehicle fuel (see Appendix Table 4). The basic assumption used for input allocation is that ‘the cost is allocated to an output with respect to income share of that output in total income of all outputs’ (Assumption 1). The assumption is based on a method named “*sales value at splitoff method*” (Horngren et al., 2012, p. 580).

Figure 2. Average output prices (€ per unit)



Source: Authors’ estimations based on survey panel data of 176 HH for private prices, and Custom Agency of Mongolia (2012) for social prices

We used a series of assumptions, methods and approaches based on national and international data to estimate costs. We consider all types of fixed costs as non-tradable inputs. We estimated the annual cost of fixed inputs based on the ‘capital recovery factor’ (Monke and Pearson, 1989, p. 104). We estimated private (social) prices of fixed inputs at the interest rate of Mongolia (Georgia) in 2011 and 2012 (Appendix 2). For non-tradable intermediate inputs, except land, we used the ‘standard conversion factor (SCF)’ developed by Squire and van der Tak (1975, p. 73).

2.5. Results and Discussions

2.5.1. Incomes and costs

The average household earns €3,312.8 (€3,636.3) in private prices in 2011 (2012). About 82% (84%) of total income is due to only 4 types of products: cow milk 26% (25%), goat cashmere 23% (17%), goat meat 21% (28%), cattle meat 12% (14%) in 2011 (2012) (Appendix Table 3). Goats account for 50.2% of total income, whereas cattle, sheep, horses, and camels account for 38.8%, 6.6%, 2.7%, and 1.7%, respectively. This suggests that goats and cattle are the most important (about 90% of total private income) livestock for earning private income for HH⁴.

Table 3. Annual private income per household, by household type (€)

| HH type | 2011 | | 2012 | | Change in mean (%) |
|------------------|-----------------|--------------------|-----------------|--------------------|--------------------|
| | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) | |
| Small (<100) | 1,843.2±740.3 | (498-4,533.4) | 1,984.9±797.3 | (479.7-4,267.5) | 7.7% |
| Medium (100-200) | 3,837.1±1,277.1 | (1,935.6-7,678.2) | 3,800.9±1,385.3 | (1,195.2-9,148.5) | -0.9% |
| Large (>200) | 6,431±4,052.9 | (2,994.4-24,913.9) | 7,215.1±2,316.2 | (3,204.8-12,025.7) | 12.2% |
| Entire sample | 3,312.8±2,492.6 | (498-24,913.9) | 3,636.3±2,367.1 | (479.7-12,025.7) | 9.8% |

Source: Authors' estimations

From 2011 to 2012, income from livestock production increases by 9.8% over the entire sample. Additionally, the income difference between small and large households increases from €4,588 to €5,230 between 2011 and 2012.

Table 4. Total cost, by types of inputs (€)

| Cost type | 2011 | | | | 2012 | | | |
|--------------------|-------------|-------------|-----------|-------------|-------------|-------------|-----------|-------------|
| | Private | | Social | | Private | | Social | |
| | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) |
| Domestic | 318±365 | (14-3,300) | 296±341 | (13-3,094) | 372±362 | (18-2,292) | 324±315 | (16-2,011) |
| Factor | 441±374 | (12-3,472) | 404±342 | (11-3,181) | 532±364 | (7-2,296) | 489±334 | (6-2,110) |
| (C) | 964±413 | (11-2,140) | 883±378 | (10-1,960) | 1,180±505 | (82-3,185) | 1,084±464 | (75-2,927) |
| Land | 0 | 0 | 65±59 | (5-513) | 0 | 0 | 76±70 | (3-639) |
| Tradable input (B) | 129±209 | (0-882) | 115±185 | (0-783) | 154±242 | (0-1,034) | 137±217 | (0-924) |
| Total (C+B) | 1,852±1,017 | (215-9,794) | 1,777±994 | (204-9,629) | 2,237±1,023 | (358-6,403) | 2,110±978 | (336-6,426) |

Source: Authors' estimations

We estimated SCF of Mongolia as 0.916 in 2011 and 0.919 in 2012, to convert prices of domestic factors into social prices (Appendix Table 6). For the price of labour, we assumed that the **poverty line** reflects the private price of labour for herders because there are not many other opportunities in rural areas apart from herding (NSOM, 2015d). We converted private salary (€1.89 in 2011, €2.24 in 2012) per person per day by SCF to estimate the social salary (€1.73 in 2011, €2.06 in 2012)⁵. We assumed the social cost of pastureland equals to the livestock tax rate reflected by the asset tax law proposal submitted to Parliament in 2014 (Government of Mongolia, 2014b). This law proposal introduces tax sheep unit (TSU) instead of SHU. One head of sheep equals to 1 TSU, goat 2 TSU (i.e. goat is taxed 2 times higher than sheep), cattle

⁴ Percentage shares of total income by livestock types are not much different in both years.

⁵ The poverty line is measured by months (99,729 MNT in 2011, 118,490 MNT in 2012 per person per month), which is divided into 30 days to estimate price of labour per person per day. 1€=1,761MNT, which is the annual average exchange rate of 2011 reported by the Central Bank of Mongolia (2015).

and horse 5 TSU, camel 2 TSU. Annual tax per TSU is €0.284 (500 MNT)⁶. The only tradable input is vehicle fuel used for transportation of seasonal movement, and the import price data was obtained from the Custom Agency of Mongolia, 2012, Appendix 2).

On average, a household spends about €1,852 (€2,237) per year and makes a profit of about €1,461 (€1,399) in 2011 (2012) from the private perspective. The social cost is slightly lower than the private cost (see Appendix Table 7 and Appendix Table 8). Labour shares 52.4% in the total cost, two years' average, and shows that livestock farming is labour intensive.

Note that the cost on pastureland does not make a notable difference between the private and social costs. Our estimated pastureland cost is too small compared to other costs. Private herders spend no cost for grazing their livestock on pastures, but it could have costs from a social perspective based on the livestock tax law proposal (Government of Mongolia, 2014b). Pastureland cost accounts for about 3.6% of the total social cost in both years. However, the tax ranging from zero to 1000 MNT per TSU is likely political. Having zero tax can be explained in that politicians are reluctant to levy taxes on herder communities, as these communities have strong voting power. Furthermore, an appropriate approach is needed for estimating the pastureland cost, which takes into account environmental and socio-economic aspects, rather than political. Secondly, the year 2011 and 2012 were just after the heavy *Dzud* in 2010. In other words, livestock loss was quite high and the number of livestock to be taxed reduced. Hence, the fewer livestock reduces the total cost of tax, which is supposed to reflect the cost of the land. This can be intuitive as Dietz et al. (2005, p. 3) found that there is an over use of the pastureland beyond its carrying capacity before a *Dzud*, but after a *Dzud* environmental regeneration occurs when livestock numbers are below the carrying capacity. Hence, land costs share a smaller portion of the total social cost just after *Dzud*. We discuss different social cost of land use in more detail at section 2.5.5.

2.5.2. Competitiveness by outputs

Kernel distributions of PCB ratios show that most of the livestock products are privately competitive, except for horsehair & tail and sheep wool (Appendix Figure 2). The average SCB ratios of meat and hide of all livestock (except camel), and camel wool are higher than average PCB ratios. This reveals that the social competitiveness of these products is less than their private competitiveness.

Average SCB ratios of all types of milk and goat cashmere and sheep wool are less than the average PCB ratios for these products, meaning that these are socially more competitive. PCB and SCB ratios differ slightly between 2011 and 2012, except the SCB ratios of goat and sheep hide (Appendix Figure 2).

Results for the outputs produced by only a few HH may not be reliable ('# of HH' Table 5). For example, only 2 (3) HH out of 176 produced camel milk in 2011 (2012), and less than 20 households in the sample produced milk of sheep, horse and camel, and meat and hide of camel (Table 5). Hence, we compared the competitiveness of outputs excluding these five types of outputs below.

⁶ The proposed amount of tax per TSU was between zero and 1000 MNT (€0.57), we took the average.

Table 5. Ranking of competitiveness, by output and livestock

| Type | Output | 2011 | | | | 2012 | | | | | |
|-----------------------|-----------|------------|------------------------------------|-----------------|-----------------------------------|-----------------|------------|------------------------------------|-----------------|-----------------------------------|-----------------|
| | | # of HH | Privately competitive HH (0<PCB<1) | | Socially competitive HH (0<SCB<1) | | # of HH | Privately competitive HH (0<PCB<1) | | Socially competitive HH (0<SCB<1) | |
| | | | Share (%) | Rank | Share (%) | Rank | | Share (%) | Rank | Share (%) | Rank |
| Goat | Meat | 174 | 80.5% | 9 | 67.2% | 9 | 175 | 72.0% | 9 | 45.1% | 10 |
| | Hide | 174 | 77.0% | 11 | 67.2% | 10 | 175 | 70.9% | 10 | 19.4% | 13 ^L |
| | Milk | 119 | 68.1% | 13 ^L | 98.3% | 2 ^T | 79 | 58.2% | 13 ^L | 96.2% | 3 ^T |
| | Cashmere | 175 | 78.3% | 10 | 85.7% | 7 | 173 | 70.5% | 11 | 89.0% | 6 |
| GOATS TOTAL** | | 175 | 76.6% | 4 | 81.1% | 2 | 176 | 69.9% | 3 | 71.6% | 2 |
| Sheep | Meat | 114 | 85.1% | 6 | 27.2% | 13 ^L | 100 | 74.0% | 7 | 38.0% | 11 |
| | Hide | 114 | 84.2% | 8 | 66.7% | 11 | 100 | 73.0% | 8 | 17.0% | 14 ^L |
| | Milk* | 13 | 76.9% | * | 100.0% | * | 15 | 53.3% | * | 93.3% | * |
| | Wool | 84 | 69.0% | 12 ^L | 90.5% | 6 | 79 | 63.3% | 12 ^L | 96.2% | 2 ^T |
| SHEEP TOTAL** | | 122 | 79.5% | 3 | 35.2% | 5 | 108 | 68.5% | 4 | 46.3% | 4 |
| Cattle | Meat | 122 | 99.2% | 1 ^T | 96.7% | 3 ^T | 120 | 94.2% | 3 ^T | 95.0% | 4 |
| | Hide | 122 | 96.7% | 2 ^T | 96.7% | 4 | 120 | 93.3% | 4 | 88.3% | 7 |
| | Milk | 158 | 94.9% | 5 | 99.37% | 1 ^T | 154 | 90.3% | 5 | 99.35% | 1 ^T |
| CATTLE TOTAL** | | 166 | 95.2% | 1 | 98.8% | 1 | 166 | 91.0% | 1 | 97.0% | 1 |
| Horse | Meat | 30 | 96.7% | 3 ^T | 93.3% | 5 | 35 | 94.3% | 1 ^T | 91.4% | 5 |
| | Hide | 30 | 96.7% | 4 | 80.0% | 8 | 35 | 94.3% | 2 ^T | 74.3% | 8 |
| | Milk* | 11 | 72.7% | * | 90.9% | * | 3 | 66.7% | * | 100.0% | * |
| | Hair&tail | 70 | 20.0% | 14 ^L | 18.6% | 14 ^L | 65 | 30.8% | 14 ^L | 30.8% | 12 ^L |
| HORSES TOTAL** | | 91 | 37.4% | 5 | 37.4% | 4 | 81 | 42.0% | 5 | 42.0% | 5 |
| Camel | Meat* | 10 | 90.0% | * | 90.0% | * | 3 | 100.0% | * | 100.0% | * |
| | Hide* | 10 | 90.0% | * | 100.0% | * | 3 | 100.0% | * | 100.0% | * |
| | Milk* | 2 | 100.0% | * | 100.0% | * | 3 | 100.0% | * | 100.0% | * |
| | Wool | 76 | 84.2% | 7 | 65.8% | 12 ^L | 76 | 84.2% | 6 | 63.2% | 9 |
| CAMELS TOTAL** | | 77 | 83.1% | 2 | 64.9% | 3 | 76 | 84.2% | 2 | 64.5% | 3 |

Source: Authors' estimation

Note: ^T Top three (Rank 1-3); ^L Lowest three (Rank 12-14); * Non-ranked outputs due to small sample size; ** Ranked among livestock types

The most competitive outputs, from the private perspective, are meat and hide of cattle and horse. The most competitive output, from the social perspective, is cow milk, because 99.37% (99.35%) of cow milk producing HH are competitive in 2011 (2012). It is an intuitive result because cow milk is an important food source for rural households. Herders are not able to sell the raw milk on central markets due to its required transportation conditions and related high costs. However, it is possible to transform the milk into dairy products like dried curd and classified butter, which makes it easy to store and transport. The next most socially competitive outputs are goat milk and beef in 2011 and sheep wool and goat milk in 2012.

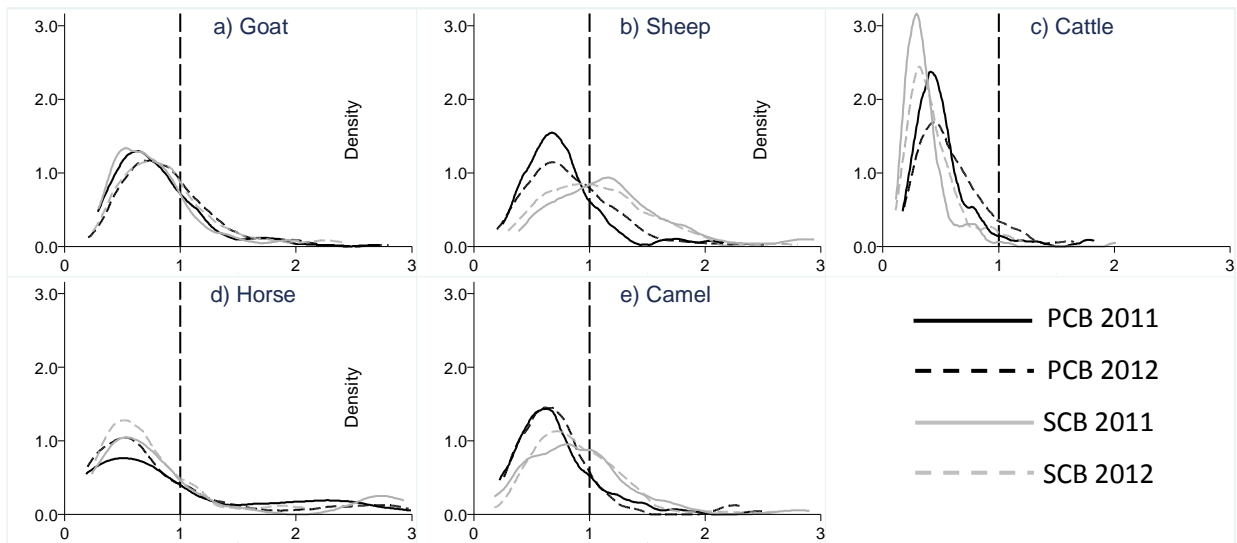
The least competitive output, from the private perspective, is horsehair & tail for both years; as only 20.0% (30.8%) of HH who produced horsehair & tail are profitable in 2011 (2012). The least competitive outputs, from the social perspective, are horsehair & tail in 2011 and sheep hide in 2012. It is reasonable given the export price of sheep hide reduced sharply between 2011 and 2012, and the unit cost increased slightly, which resulted in the share of socially competitive households for sheep hide to reduce significantly (Figure 2, Table 5, and Appendix Table 8). Overall, the competitiveness level reduced for most of the outputs except for cashmere and sheep meat and wool (for the social perspective) and horsehair & tail (both social and private perspectives) from 2011 and 2012⁷.

⁷ Export price of goat cashmere dropped, but cost per kg dropped more. Conversely, social price of sheep meat increase was much higher than the cost increase. For horsehair & tail both private and social unit costs decreased more than the price drop.

2.5.3. Competitiveness by livestock types

In order to compare livestock types, we aggregated the incomes and costs of each livestock type within each household. For example, a household produces meat, hide and cashmere from goats, but no milk, and then only the incomes and costs of these three outputs are summed up. Figure 3 and Table 5 show the private and social competitiveness of livestock production by types. The most competitive livestock type is cattle because most of the PCB and SCB ratios plotted are between zero and one.

Figure 3. Kernel Distribution of PCB and SCB ratios, by livestock types in 2011 and 2012



Source: Authors' estimation

Note: PCB and SCB ratios over 3.0 are not depicted on the graphs – this is the case for sheep and horse. A PCB (SCB) ratio between 0 and 1 represents that given livestock production is competitive from the private (social) perspective.

Thereafter, the goat and camel production types follow. For horse, the figure is inconclusive because the graph does not show the non-competitive households, where the PCB and SCB are greater than 3.0 (Figure 3). The general patterns of distributions of competitiveness ratios between two years are not very different.

Table 6. Average PCB and SCB ratios, by livestock type

| Type | 2011 | | 2012 | |
|--------|-------|-------|-------|-------|
| | PCB | SCB | PCB | SCB |
| Goat | 0.799 | 0.761 | 0.884 | 0.882 |
| Sheep | 1.275 | 1.291 | 1.056 | 1.065 |
| Cattle | 0.516 | 0.364 | 0.585 | 0.427 |
| Horse | 5.065 | 4.497 | 3.462 | 4.713 |
| Camel | 0.729 | 0.912 | 0.764 | 0.960 |

Source: Authors' estimation

Normally, PAM researchers draw conclusions based on averages of PCB and SCB ratios. In this respect, horse and sheep are both privately and socially non-competitive livestock because the average PCB and SCB ratios for both years are higher than one (Table 6). It draws attention to the fact that average ratios cannot completely reveal the insights into competitiveness. This is because outliers in the sample affect

the averages (Nivievskiy and von Cramon-Taubadel, 2009). For instance, horse is the worst, because the average PCB is 5.06 (3.46) and the SCB is 4.50 (4.71) in 2011 (2012). However, still around one third of horse farmers are competitive in both the private and social perspectives, which cannot be illustrated by average ratios. The key for being competitive at horse farming is to slaughter the horse for meat and hide production simultaneously. Competitive horse farmers produce about 97.2% (94.2%) of the total production volume of horse meat and hide in 2011 (2012). Nonetheless, horses are a kind of input for production, e.g., to herd all other types of livestock, and for transportation. In addition, herders enjoy horse racing as a part of their culture. It gives the herders cultural and spiritual benefits from being a nomadic herder. Hence, it is reasonable that horse is ranked at the lowest in competitiveness for producing economic outputs, as the intrinsic value of the horse is difficult to take into account with our approach. To some extent, the situation for camels is similar.

The other three livestock production systems are competitive, and cattle production is the most competitive as both PCB and SCB ratios are closest to zero compared to other livestock types. For cattle and goat, the average PCB ratio is higher than the average SCB ratio, consistently over the two years. In 2011, the average PCB for cattle (goat) was 0.52 (0.80) and SCB was 0.36 (0.76).

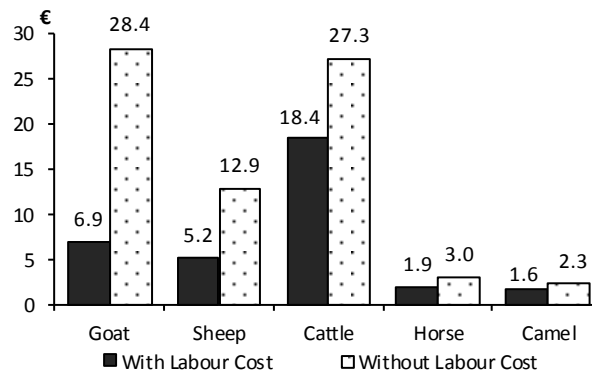
Thirty-seven percent (42.0%) of HH producing horse and 79.5% (68.5%) of HH producing sheep are competitive from the private perspective in 2011 (2012, Table 5). From the social perspective, 37.4% (42.0%) of HH producing horse and 35.2% (46.3%) of HH producing sheep are competitive in 2011 (2012).

In terms of share of competitive HH, the most competitive livestock is cattle, as 95.2% (91.0%) of HH who raised cattle are privately competitive, and 98.8% (97.0%) are socially competitive in 2011 (2012, Table 5). This depicts the same result as the ranking of average PCB and SCB ratios. In addition, cattle and camels are more easily protected against and less likely to be lost to wolves and thieves compared to other livestock types. Hence, the cost of livestock loss and purchase is less for cattle and camel.

The second ranked livestock in terms of share of HH who are competitive from the private (social) perspective is camel (goat) for both years. The cost for camel production is low, and camel wool is the only common output compared to camel meat, hide and milk. Camel wool receives a comparably high price compared to other hair products, except goat cashmere (Figure 2). For goat, the most of the goat herders generate income from cashmere. The unit private cost of cashmere is higher than the social cost, and its private price is lower than the social price. Hence, the social competitiveness level of goat cashmere is higher than private level.

Overall, livestock production types, except for horse, are competitive from the private perspective, given that more than 70% of the households operate competitively for each type of livestock. The cattle and goats are more socially competitive than privately, because the share of socially competitive HH is higher. This may be due to inefficient supporting policies. The livestock sector is supported by the Government of Mongolia, for example the 'Mongol livestock Policy' national programme (Parliament of Mongolia, 2010). The herders free of charge use of pastureland, cheap hay and fodder when a *Dzud* approaches, livestock well infrastructure installed and maintained, and free livestock vaccinations are all examples of livestock supporting policies (Lecraw et al., 2005).

Figure 4. Private profit per SHU with and without labour cost scenarios, by livestock types (€)



Source: Authors' estimation

Note: The private profits are average of 2011 and 2012 per HH, for respective livestock type

We tested private profitability with and without labour cost, because often labour is unpaid, i.e., assuming herding labour as free family labour. In the situation without labour costs, the goat becomes the most privately profitable livestock, but cattle is a very close second (Figure 4). On the contrary, when the labour cost is set to be equal to the poverty line, then the cattle is the most profitable livestock, but goat is far behind. This is because cattle do not require constant labour for rearing and herding, because they graze the pasture in the morning and come back in the evening by themselves.

Goats (and sheep) require more daily labour input to herd; hence, labour costs reach about half of the total costs. It can be seen from the Figure 4. Therefore, the labour cost dramatically influences the goat production, which related to the fact that cashmere provides high income. Based on assumption 1, higher income attaches higher cost. Hence, the goat farming becomes more costly as the most of the income for goat is drawn from cashmere.

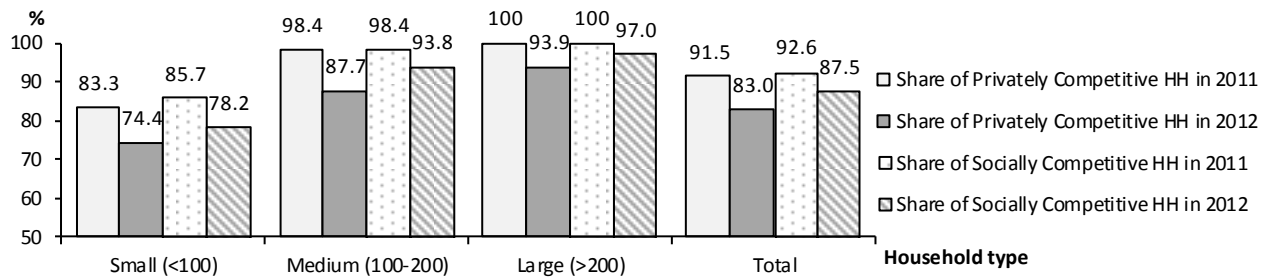
Sheep require almost the same amount of labour as goat. Compared to goat, sheep does not produce high value products like cashmere. Hence, the high labour cost burdens the social competitiveness of sheep ranked 5th (4th) below goats in 2011 (2012). However, private competitiveness for sheep is still high, as 79.5% (68.5%) of households who raise sheep are profitable in 2011 (2012).

2.5.4. Competitiveness by households

This section discusses the characteristics of households who make profits in terms of private and/or social perspectives. A single household can make profit from different types of livestock and outputs. To assess the competitiveness by household as a production unit, we aggregated total cost and income of livestock for each household, irrespective of livestock type or output.

Over the entire sample, 91.5% (83.0%) of households are privately and 92.6% (87.5%) are socially competitive in 2011 (2012). The share of privately competitive households is less than socially competitive ones and the private interest rate is higher than the social one. The standard conversion factor is below one, which indicates that the input cost (except labour and land) is high for private herders compared to social opportunity cost. However, the divergence is not too great between private and social competitiveness levels.

Figure 5. Share of competitive households, by household type (%)



Source: Authors' estimation

Figure 5 shows that 83.3% (74.4%) of households that keep less than 100 livestock in SHU, are competitive from the private perspective in 2011 (2012). On the other hand, 100% (93.9%) of households that keep more than 200 livestock in SHU, are privately competitive in 2011 (2012). This may be evidence of *economies of scale* in HH for livestock production. However, it is evident that the share of socially competitive HH was higher than privately competitive HH for both years, irrespective of household type. As shown in Figure 5, each share decreased from 2011 to 2012. The decrease of the competitiveness level can be due to growth in the number of livestock, the price drop of cashmere, the decreased volume of some output products, and the increase of labour costs (Table 4).

To compare households by number of different types of livestock they keep (*economies of scope*, Panzar and Willig, 1981), we divided households in five categories. The categorization is based on combinations of livestock types that one household can have at most. It includes 1) All 5, the HH has all five types of livestock, 2) all 4, the HH have goat, sheep, cattle and horse (no camel), 3) all 3, the HH has goat, cattle, and horse (no sheep and camel), 4) Only 2, the HH have goat and cattle (no sheep, horse and camel).

Table 7. Privately competitive households, by HH type

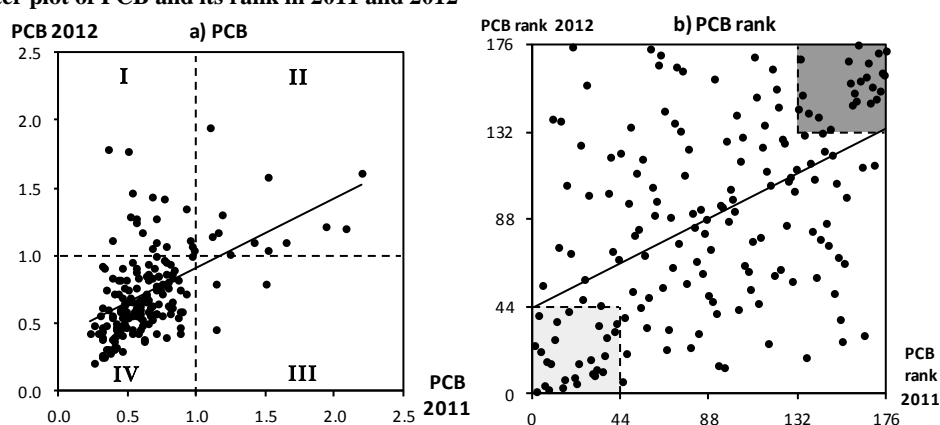
| HH type | 2011 | | | 2012 | | |
|---------|---------|-------------------------|--|---------|-------------------------|--|
| | # of HH | Share of competitive HH | Average number of livestock per HH (SHU) | # of HH | Share of competitive HH | Average number of livestock per HH (SHU) |
| Other | 31 | 87.1% | 87 | 27 | 81.5% | 96 |
| Only 2 | 13 | 76.9% | 31 | 10 | 60.0% | 33 |
| All 3 | 25 | 84.0% | 66 | 21 | 81.0% | 77 |
| All 4 | 38 | 94.7% | 133 | 47 | 80.9% | 136 |
| All 5 | 69 | 97.1% | 195 | 71 | 88.7% | 208 |
| Total | 176 | 91.5% | 132 | 176 | 83.0% | 146 |

Source: Authors' estimation

In Table 7, 69 households keep all five types of livestock, which is the highest among other HH types that keep different combinations of livestock types. The share of privately competitive households and number of livestock are highest for them (All 5), and the least for HH who keeps only goat and cattle (Only 2). Therefore, we conclude firstly that number of livestock and number of types of livestock are positively correlated (correlation coefficient 0.41 for pooled data). Secondly, HH who keep more types of livestock tend to be more privately competitive.

Furthermore, we tested if there is a significant difference between the ranks of households in terms of being competitive in both of the two years. All households are ranked from best (1) to worst (176) in terms of private competitiveness (PCB ratio). The correlation coefficient of the ranks between the two years is 0.51 ($p < 0.01$), positive significant. This suggests that the better households are consistently better for the two years. Thus, there is a systematic difference between better and worse households. To be precise, 26 (22) HH were the best (worst) households in both years out of 44 as a one quartile sample ranked at the highest (lowest), shown in Figure 6.b).

Figure 6. Scatter plot of PCB and its rank in 2011 and 2012



Source: Authors' estimation

Note: In graph a), the linear line shows the fitted line; PCB between 0 and 1 represents that the HH is competitive in private perspective;

In graph b), bottom left box shows the best 28 HH and top right box shows the worst 27 HH under one quartile data set in both years.

Figure 6.a) shows the correlation between PCB of each HH over the two years. In the first (I) quarter of the plot, upper left, HH shifted from competitive to non-competitive between 2011 and 2012. In the second (II) quarter, HH stayed as non-competitive in both years. The third (III) quarter shows the HH who shifted from non-competitive to competitive status. The fourth (IV) quarter contains the HH who stayed competitive in both years. The implication is that the number of HH who stayed competitive (at IV) and non-competitive (at II) is more than other two quarters (at I and III). Hence, we reveal that our analysis catches the robust implications for HH competitiveness over two years.

Table 8-12 compare the most and the least competitive households based on pooled average data from 2011 and 2012 per HH. In addition, we recorded data for 2011 for *Dzud* livestock loss, subcounty, characteristics of HH head, and ethnicity.

Table 8. The most vs least competitive HH comparison, by livestock number and livestock loss

| Household Type | Subcounties | # of HH | Livestock number per household (SHU (%)) | | | | | Share of livestock loss during <i>Dzud</i> 2010 (%)* | |
|---------------------------------|---------------|-----------|--|----------------|----------------|----------------|---------------|--|-------------|
| | | | Goat | Sheep | Cattle | Horse | Camel | | Total |
| The most competitive household | <i>Baitag</i> | 11 | 61(24%) | 38(15%) | 88(35%) | 37(15%) | 27(11%) | 250(100%) | 38.4 |
| | Others | 15 | 48(27%) | 11(6%) | 79(45%) | 26(15%) | 12(7%) | 176(100%) | 58.2 |
| | Total | 26 | 53(26%) | 22(11%) | 83(40%) | 31(15%) | 18(9%) | 207(100%) | 49.8 |
| The least competitive household | <i>Baitag</i> | 1 | 50(38%) | 23(18%) | 26(20%) | 14(10%) | 18(14%) | 131(100%) | 61.1 |
| | Others | 21 | 29(41%) | 3(4%) | 19(28%) | 15(21%) | 4(6%) | 70(100%) | 65.8 |
| | Total | 22 | 30(41%) | 4(5%) | 20(27%) | 15(20%) | 5(7%) | 72(100%) | 65.6 |

Source: Authors' Estimation

*The percentage of livestock loss is estimated by the formula $LOSS/(LOSS+STOCK)$ where $LOSS$ – Total Livestock Loss (in SHU) due to *Dzud* in 2010, $STOCK$ – Total Number of Livestock (in SHU) at end of 2011 (after *Dzud*), $LOSS+STOCK$ – Number of livestock before *Dzud*.

In terms of farm size, the most competitive household has 135 SHU livestock more and has a 15.8% livestock loss rate below that of the least competitive HH, and the differences are statistically significant (Table 8). The most competitive HH keep more cattle (40%) and fewer goats (26%), it may relate to our result in the previous section that the cattle is the most competitive livestock type. In *Dzud* 2010, the most competitive households lost about 49.8% of their livestock; however, it is 65.6% for the least competitive households. This implies that the most competitive households better managed their affairs prior and during the *Dzud*. Herders of *Baitag* subcounty managed to have the least livestock loss during the *Dzud* 2010 compared to the other five subcounties; because, their winter camp area was least affected during the disaster. As a result, their livestock population was largest, and they share 42% of the most competitive HH.

Table 9. The most vs least competitive HH, share of private income by output and livestock type (%)

| Household type | Goat | | | | | Sheep | | | | | Cattle | | | | Horse | | | | Camel | | | | Total | | |
|-----------------------|-------|------|------|----------|--------------|-------|------|------|------|------------|--------|------|------|-------------|-------|------|------|-----------|-------------|------|------|------|-------|-------------|-------|
| | Meat | Hide | Milk | Cashmere | TOTAL | Meat | Hide | Milk | Wool | TOTAL | Meat | Hide | Milk | TOTAL | Meat | Hide | Milk | Hair&tail | TOTAL | Meat | Hide | Milk | | Wool | TOTAL |
| The most competitive | 17.6 | 1.0 | 2.4 | 15.0 | 36.0 | 8.4 | 0.4 | 0.2 | 0.1 | 9.0 | 16.0 | 0.3 | 36.1 | 52.4 | 1.5 | 0.0 | 0.1 | 0.0 | 1.7 | 0.4 | 0.0 | 0.0 | 0.7 | 1.0 | 100 |
| The least competitive | 30.7 | 1.7 | 7.8 | 21.1 | 61.3 | 2.6 | 0.1 | 0.1 | 0.0 | 2.9 | 10.4 | 0.2 | 19.7 | 30.2 | 4.2 | 0.1 | 0.0 | 0.0 | 4.4 | 1.0 | 0.0 | 0.0 | 0.2 | 1.2 | 100 |
| Difference | -13.1 | -0.7 | -5.4 | -6.1 | -25.3 | 5.8 | 0.3 | 0.1 | 0.1 | 6.1 | 5.6 | 0.1 | 16.4 | 22.2 | -2.7 | -0.1 | 0.1 | 0.0 | -2.7 | -0.6 | 0.0 | 0.0 | 0.5 | -0.2 | 0 |
| | *** | *** | *** | ** | *** | *** | *** | | | * | *** | † | ** | *** | * | * | | * | * | | | | | * | |

Source: Authors' Estimation

* The difference is significant $p < 0.1$; ** Significant $p < 0.05$; *** Significant $p < 0.01$; † Significant $p < 0.15$

Based on the output ratio, the most competitive HH earn the most of their private income from cattle (52.4%), but it is goat (61.3%) for the least competitive HH (differences are statistically significant). Furthermore, goat meat is the key output for the least competitive HH, but cow milk is most relevant for the most competitive HH.

Table 10. The most vs least competitive HH, comparison by percentage of input cost share (%)

| Household type | Fixed Input Cost Share (%) | | | | | | Intermediate Input Cost Share (%) | | | | | | | | | | Total | | |
|-----------------------|----------------------------|-------|--------|-------|-------|-------------|-----------------------------------|-------|--------|-------|-------|-------------|---------|-------|--------|-------|-------|-------------|-------|
| | Goat | Sheep | Cattle | Horse | Camel | Total | Labour | | | | | Total | Capital | | | | | Total | |
| | | | | | | | Goat | Sheep | Cattle | Horse | Camel | | Goat | Sheep | Cattle | Horse | | | Camel |
| The most competitive | 5.7 | 1.5 | 7.9 | 0.3 | 0.2 | 15.6 | 24.8 | 5.1 | 21.8 | 0.4 | 0.3 | 52.3 | 14.2 | 4.4 | 12.0 | 1.0 | 0.4 | 32.1 | 100 |
| The least competitive | 10.8 | 0.7 | 6.1 | 1.2 | 0.3 | 19.1 | 39.3 | 1.6 | 10.4 | 1.1 | 0.3 | 52.7 | 17.7 | 0.9 | 7.9 | 1.3 | 0.4 | 28.3 | 100 |
| Difference | -5.1 | 0.8 | 1.8 | -0.9 | -0.1 | -3.5 | -14.5 | 3.5 | 11.4 | -0.7 | 0.0 | -0.4 | -3.5 | 3.5 | 4.1 | -0.3 | 0.0 | 3.8 | 0.0 |
| | *** | * | | ** | | | *** | *** | *** | † | | | † | * | ** | | | | |

Source: Authors' Estimation

* The difference is significant at $p < 0.1$; ** Significant at $p < 0.05$; *** Significant at $p < 0.01$; † Significant at $p < 0.15$

The cost shares differ slightly between the most and least competitive HH. The labour (capital) cost is 52.3% (32.1%) of the total cost for the most competitive HH, and it is 52.7% (28.3%) for the least competitive HH. After aggregating the cost shares by livestock type, the goat pertains to the highest portion of total cost for both the most and least competitive HH. The most (least) competitive HH spend 44.7% (67.8%) of the total cost for goats, and 41.7% (24.4%) for cattle. This result is statistically significant.

Table 11. The most vs least competitive HH, comparison by household characteristics

| Household type | Family size (persons) | Household Head | | | Probability to be <i>Kazakh</i> family (%) | Prepared hay per SHU (Kg) |
|-----------------------|-----------------------|----------------|-------------------|----------------------------|--|---------------------------|
| | | Age (years) | Schooling (years) | Herding experience (years) | | |
| The most competitive | 4.8 | 52.6 | 7.0 | 27.5 | 15.4 | 136.8 |
| The least competitive | 5.9 | 40.6 | 6.1 | 23.5 | 63.6 | 145.1 |
| Difference | -1.1 ** | 12.0 *** | 0.9 | 4.0 | -48.2 *** | -8.3 |

Source: Authors' Estimation;

* The difference is significant at $p < 0.1$; ** Significant at $p < 0.05$; *** Significant at $p < 0.01$; † Significant at $p < 0.15$

In the most competitive HH, the HH head has greater years of schooling and more herding experience, compared to the least competitive HH, but the differences are not statistically significant. However, significant differences occur between the two groups for family size, age of HH head and probability to be *Kazakh*. *Kazakh* HH, especially in *Bayansudal* subcounty, in *Bulgan* county have a higher number of children and tend to be more vulnerable to *Dzud* comparing to *Torguud* Mongols. *Kazakh* families have fewer number of livestock that makes them poorer.

Table 12. The most vs least competitive HH, comparison by household mobility indicators

| Household type | Moving method | Obs | Moved distance between seasonal camps (KM) | | | | | Number of days stayed longer than 91 days in one seasonal camp | | | | | Number of moves made | Cost of mobility (€) | | | |
|-----------------------|--------------------|-----------|--|-------------|-------------|-------------|--------------|--|-------------|------------|-------------|--------------|----------------------|----------------------|--------------|--------------|-------------|
| | | | Win-Spr | Spr-Sum | Sum-Aut | Aut-Win | Total | Win | Spr | Sum | Aut | Total | | Labour | Fuel | Total | per SHU |
| The most competitive | Truck (A) | 8 | 20.3 | 106.6 | 90.1 | 13.1 | 230.1 | 32.4 | 30.5 | 0.1 | 5.2 | 68.1 | 5.5 | 86.9 | 378.4 | 465.3 | 1.5 |
| | Camel (B) | 18 | 10.5 | 86.0 | 73.7 | 21.0 | 191.2 | 14.1 | 40.8 | 12.8 | 54.7 | 122.4 | 1.9 | 34.6 | 0.0 | 34.6 | 0.1 |
| | Total (C) | 26 | 13.5 | 92.3 | 78.7 | 18.6 | 203.2 | 19.7 | 37.6 | 8.9 | 39.5 | 105.7 | 3.0 | 50.7 | 116.4 | 167.1 | 0.6 |
| The least competitive | Truck (D) | 10 | 19.8 | 60.6 | 66.5 | 28.1 | 175.0 | 31.1 | 32.9 | 0.1 | 14.8 | 78.8 | 3.9 | 56.0 | 181.1 | 237.1 | 6.7 |
| | Camel (E) | 12 | 10.8 | 84.4 | 93.2 | 24.6 | 213.0 | 18.5 | 42.8 | 4.8 | 47.5 | 113.5 | 3.6 | 51.5 | 4.9 | 56.4 | 0.6 |
| | Total (F) | 22 | 14.9 | 73.6 | 81.0 | 26.2 | 195.7 | 24.2 | 38.3 | 2.7 | 32.6 | 97.7 | 3.7 | 53.6 | 85.0 | 138.6 | 3.4 |
| Differences | Truck (A-D) | - | 0.5 | 46.0 | 23.6 | -15.0 | 55.1 | 1.3 | -2.4 | 0.0 | -9.6 | -10.7 | 1.6 | 30.9 | 197.3 | 228.2 | -5.2 |
| | Camel (B-E) | - | -0.3 | 1.6 | -19.5 | -3.6 | -21.8 | -4.4 | -2.0 | 8.0 | 7.2 | 8.9 | -1.7 | -16.9 | -4.9 | -21.8 | -0.5 |
| | Total (C-F) | - | -1.4 | 18.7 | -2.3 | -7.6 | 7.5 | -4.5 | -0.7 | 6.2 | 6.9 | 8.0 | -0.7 | -2.9 | 31.4 | 28.5 | -2.8 |

Source: Authors' Estimation;

Note: Win- winter; Spr-spring; Sum- summer; Aut- autumn

* The difference is significant at $p < 0.1$; ** Significant at $p < 0.05$; *** Significant at $p < 0.01$; † Significant at $p < 0.15$

The literature agrees that increasing mobility reduces pastureland degradation in Mongolia (Bedunah and Schmidt, 2004; Fernandez-Gimenez, 2000; Fernandez-Gimenez and Le Febre, 2006; Lkhagvadorj et al., 2013). However, transportation costs, accessibility to pastures, pasture condition, and water resources are factors that restrict the nomadic mobility (Fernández-Giménez, 2001).

Table 12 shows that the most competitive HH tend to be less mobile than the least competitive HH according to number of days stayed longer on a specific pasture in one season and the number of moves made per year⁸. Following papers explain the reasons based on income level of the HH. **Firstly**, Fernandez-Gimenez and Batbuyan (2004) find that poorer households tend to move more than richer HH; because, more than half of the poorer households have no secure seasonal campsites, and use other's land; hence they have to move more often. **Secondly**, Addison and Brown (2014) conclude that mobility for poor or remote HH is a significant alternative for livestock production, rather than purchasing fodder (or hay) from the market. **Thirdly**, Lkhagvadorj et al. (2013, p. 87, Fig 5.) plot the income and mobility

⁸ However, note that difference of these indicators between the most and the least competitive HH are not significant

status of the HH. They show that the income of traditionally (more) mobile HH is less than the reduced mobile HH.

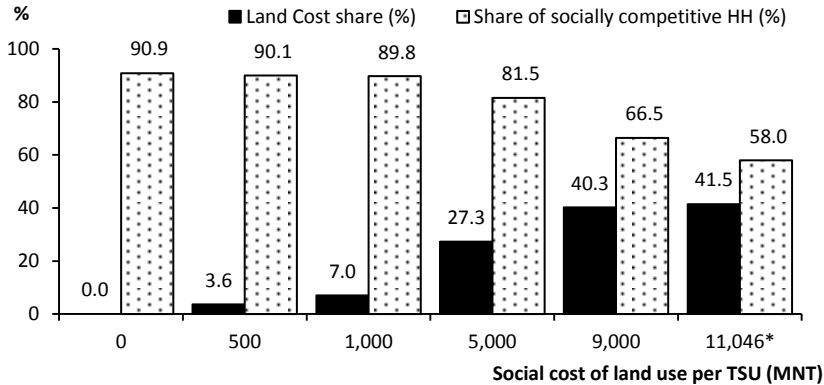
The labour for moving between (and within) seasonal camps accounts for disassembling and packing the campsite and reassembling and unpacking after the move for each HH. Additionally, labour includes bringing the livestock, on foot or horseback, between seasonal camps. In our analysis, the fuel cost accounts for moving between seasonal camps by truck. Interestingly, about 69% of the most competitive HH move by camel compared to 55% for the least competitive HH. The fuel cost shares a large proportion of the mobility cost. Although the total mobility cost for the most competitive HH is higher, the total cost per SHU is much less than for the least competitive HH, which is statistically significant. Therefore, we may say that the most competitive HH spend less for mobility than least competitive HH per livestock production unit.

2.5.5. Sensitivity analysis of the land cost

In economics, optimum number of livestock that maximizes the herders’ profit should be ideal given that the pastureland is limited (Jarvis, 1985; Shapiro K H and Ariza-Nino, 1983). To use pastureland efficiently, the individual rights for land would be recommendable but this is not feasible politically; hence, controlling livestock number may be effective policy to stop overgrazing (Jarvis, 1980). Livestock tax (grazing fee) policy can be an example of controlling livestock number on the pastureland, which we use in this study.

We run a sensitivity analysis of different social prices for land use to test how strongly this price affects the competitiveness. For ease of calculation and interpretation, we express the social price of land use in terms of MNT per TSU, which is how the proposed land tax in Mongolia is also expressed (Government of Mongolia, 2014b). We test six different social prices for land, all else constant: 1) 0 MNT per TSU; 2) Base scenario that we used in the study – 500 MNT per TSU; 3) Max rate in the asset tax law proposal – 1000 MNT per TSU; 4) 5,000 MNT per TSU; 5) 9,000 MNT per TSU; 6) The tax rate that makes mean SCB=1 (zero social profit for an average HH) – 12,644 MNT for 2011; 9,448 MNT for 2012.

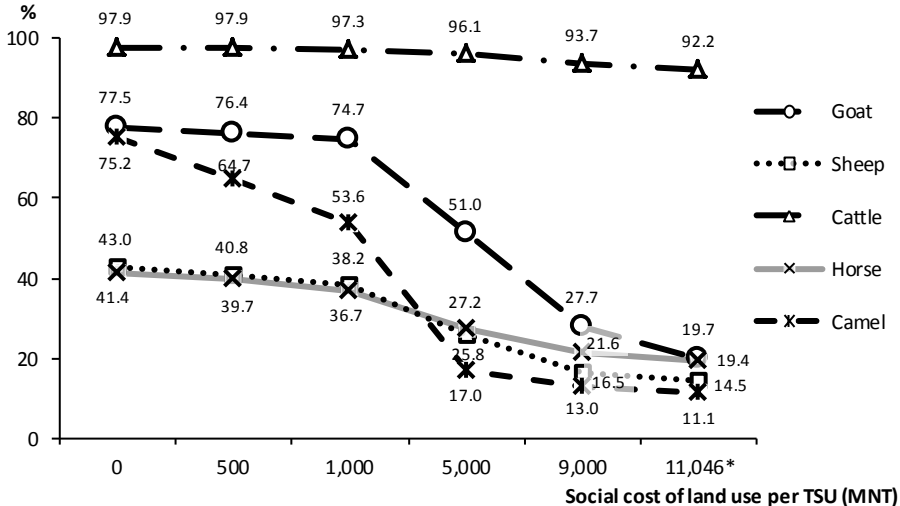
Figure 7. Land cost scenarios on cost and household competitiveness



Source: Authors’ estimation
 Note: The estimated values are average values of 2011 and 2012
 * Average tax rate of 2011 and 2012 in Scenario 6, which makes zero social profit for an average HH

Figure 7 shows that pastureland cost reaches 41.5% of the total cost if the social cost of using land is equal to 11,046 MNT per TSU, at which the average household makes no profit in social perspective. In this case, about 58% of the HH are competitive instead of 90.1% in the base scenario. Having pastureland tax of 5,000 MNT makes land cost to be 27.3% of the total cost, which is considerably higher than other input costs, except labour.

Figure 8. Share of socially competitive herder households for different types of livestock (%)



Source: Authors' estimation
 Note: The estimated values are average values of 2011 and 2012
 * Average tax rate of 2011 and 2012 in Scenario 6, which makes zero social profit for an average HH

When the cost of pastureland increases, then decline in the competitiveness of cattle production is very minor compared with other types of livestock (Figure 8). If the tax rate increases from 500 MT to about 11,046 MNT, then competitiveness level of cattle production decreases by only 5.7 percentage points, compared with 57.8 percentage points for goats. The critical decline of competitiveness of all livestock types, except cattle, starts for having 5,000 MNT tax per TSU. Hence, competitiveness of cattle production is less affected by increasing pastureland cost comparing to other types of livestock.

However, care should be taken that our analysis did not consider number of livestock (culling or calving rates etc.) directly in the production function, but produced outputs instead. In this sense, the effect of tax increase on production volume and combination of keeping different types of livestock and outputs is not possible to be shown in our analysis as we assumed all other factors remain constant. In reality, the herders as economic agents will integrate the increase of one type of cost for their choices of decisions in production pattern, which will affect the competitiveness. If the environmental costs are higher than 5,000 MNT per TSU, then this starts to affect the true (social) competitiveness of livestock production in the region significantly. As long as these environmental costs are below this value, our conclusions about competitiveness of livestock production in the region still hold.

2.6. Conclusions

Pastoral livestock production is one of the key sectors in rural Mongolia. However, an increasing number of livestock exceeding the carrying capacity of the land is becoming problematic. Herders keep goats more than other types of livestock because of its valuable cashmere. However, pastureland cost limitedly affects the competitiveness in the social perspective. The tax rate proposed by the government of Mongolia for using the pastureland is small compared to other input costs. Therefore, it reveals that the current tax policy to reduce livestock number and protect pastureland degradation has minimal effect on the private profitability of the livestock sector. Future research should improve the valuation methodology for estimating the cost of pastureland.

Pastoral livestock husbandry is competitive in both private and social perspectives, and the cattle is the most competitive livestock in Mongolia, which is evidenced by our study. Ninety-one percent (83.0%) of households are privately and 92.6% (87.5%) are socially competitive in 2011 (2012). HH that have a higher number of livestock tend to have more types of livestock and make up a high share of the competitive HH.

Our results confirm that cashmere provides the second highest (after cow milk) private income. However, earning the high cash income does not equate to earning the high profit (income minus cost). We conclude that cashmere (goat) is not the most competitive output (livestock type) both privately and socially in the case of pastoral livestock production in Mongolia.

We find that the cattle is the most competitive livestock type. First, the labour cost is much smaller for cattle than for goats and sheep. Secondly, although the cow milk does not receive high prices, it secures the food nutritional needs of the rural communities.

The most competitive HH have a significantly higher number of livestock and keep more cattle; thus they earn the majority of the income from cattle. They also have reduced livestock mortality rates during a *Dzud*. The least competitive HH earn 61.3% of the total income from goats, and spend 67.8% of the total cost for goats. On the contrary, for the most competitive HH income and cost shares are concentrated on cattle farming. The most competitive HH tend to be less mobile and mobility cost per SHU is significantly smaller. The fuel cost of mobility is crucial; hence moving by camel reduces the total mobility cost significantly. For the most competitive HH, the share of HH that use camel for seasonal movement is 15% higher than the least competitive HH.

We acknowledge the shortcomings of this study. First of all, the assumption of inputs cost allocation to outputs (Horngren et al., 2012, p. 580). The higher the (private) income share for a product, the higher the cost allocated. Regarding assumption 1: meat, hide and milk production from camel receive too little cost because income from these products is minor compared to, e.g., goat cashmere and cow milk etc.

3. ESSAY 2: “THE COMPETITIVENESS OF SEA BUCKTHORN FARMING IN MONGOLIA: APPLICATION OF POLICY ANALYSIS MATRIX”

3.1. Abstract

Sea buckthorn (*Hippophae Rhamnoides*) provides multiple products that are very nutritious and healthy. Plus, sea buckthorn mitigates against desertification. The most valuable output is oil, extracted from the pulp and seeds of the sea buckthorn berry. Scientists in the fields of ecology, botany, environmental sciences, food and medicine have studied sea buckthorn. However, there is no solid economic and market analysis for sea buckthorn, which traces back to a lack of data. We analyse the private and social competitiveness of sea buckthorn farming of 21 households in *Bulgan* county of *Khovd* province in Mongolia. We confirm that half of the interviewed sea buckthorn berry farmers are competitive, yet their level of competitiveness is not very high. This could be caused by lack of experience in sea buckthorn farming. Interestingly, the private competitiveness level is lower than the social one. Output prices are high due to government support policies; however input prices are also and even more distorted. Consequently, producers display low levels of private profitability. Hence, to improve the private competitiveness, the policies should focus towards decreasing the costs of inputs of the production system. The level of competitiveness of sea buckthorn farming has increased from 2012 to 2013, which might be due to the government’s “Sea Buckthorn National Programme”. According to interviewed producers, the most serious challenge facing sea buckthorn production is lack of finance, which is also evidenced that more than one third of the total cost of the farming is composed of investment costs.

Keywords: Sea buckthorn, berry, production, private and social competitiveness, costs, income

3.2. Introduction

Sea buckthorn is a deciduous shrub that yields berries. The berry of sea buckthorn is the fruit which is the most nutritious and rich in vitamins among other fruits (Li and Shroeder, 1996, p. 376). The critical health beneficial components of sea buckthorn products are fatty acids Omega 3, 6, 7, and 9, Vitamin C, E, A, B, and K, and mineral elements etc., (Suryakumar and Gupta, 2011; Zeb, 2004). The sea buckthorn berry can be consumed directly or used for producing nutritional and medicinal products, including juice, oil, cosmetics and pharmaceuticals (See next section for more backgrounds). The market supplements of vitamin C, E is a fast growing sector, and conveniently sea buckthorn contains a high amount of both vitamins (Storey et al., 2000).

Sea buckthorn has been widely researched in the fields of pharmacy, nutrition, medicine, biology, botany, chemistry, nutraceutical, and as a functional food. However, there is no economic analysis for the competitiveness or profitability of sea buckthorn. This is most likely due to the lack of data available on production, consumption, and the price. Therefore, there has been no policy analysis conducted for sea buckthorn farming.

The research questions to be answered in this study consist of: “Is the production of sea buckthorn berry competitive for private farmers and for the society in Mongolia?” and “What policy should be implemented to improve the competitiveness of sea buckthorn in Mongolia?”. We aim to identify if sea

buckthorn berry farming is competitive from the private and/or social perspectives and the associated policy implications. We employ the Policy Analysis Matrix (PAM) approach, developed by Monke and Pearson (1989). The PAM approach is widely used to identify the private and social level of competitiveness of production systems. Furthermore, it is used to analyse how policy affects competitiveness. In this study we use disaggregate farm level data. We interviewed 21 sea buckthorn farming households of *Bulgan* county, *Khovd* province in Mongolia. The environmental conditions, including soil, precipitation, and temperature, in *Khovd* province are similar to *Uvs* province, which is the major producing province for sea buckthorn berry. Both provinces are located in western Mongolia. *Bulgan* county is a dry and *Dzungarian* semi-desert mountainous area bordering China.

We conclude that about half of the sea buckthorn berry farming households is competitive. Critical challenges for sea buckthorn farmers are lack of finance and lack of berry processing capacity. The private competitiveness of sea buckthorn berry farming is slightly lower than that of the social competitiveness. The “Sea Buckthorn National Programme” is an efficient policy to improve competitiveness, yet government policy should additionally foster reducing the input costs.

3.3. Background

Sea buckthorn (*Hippophae Rhamnoides*) is widely grown in Asia and Europe and has been planted in North America since the 1930s (Davidson et al., 1994; Li and Shroeder, 1996; Rousi, 1971). Sea buckthorn grows between -43°C and +40°C (Rongsen, 1992), in areas with 400mm-600mm precipitation (Li and Shroeder, 1996).

A considerable number of products can be obtained from sea buckthorn. Li and Shroeder (1996) and Beveridge et al. (1999) report the range of sea buckthorn products. The berry of sea buckthorn provides volatile oil, juice, and pulp, which are raw materials to produce pharmaceuticals, cosmetics, drinks/beverages, food, and the residuals can be used for animal feed (Li and Shroeder, 1996). Two recently introduced sea buckthorn products are tea of sea buckthorn leaves and wine. The most valuable output of sea buckthorn is oil, which is extracted from pulp and seeds of the berry (Li and Shroeder, 1996).

Zeb (2004) discusses six types of therapeutic uses (health benefits or medicinal purposes) of sea buckthorn based on literature: anti-cancer (Mingyu, 1994; Zhang, 1989), cardiovascular therapy (Chai et al., 1989), treatment of gastric ulcers (Xing et al., 2002; Zhou, 1998), treatment of liver diseases (Gao et al., 2003; Zao et al.), treatment of skin diseases (Zhao, 1994), other benefits, e.g., balancing immune system, mitigating coronary heart diseases, and reducing fat (Zeb, 2004). These benefits make sea buckthorn an exceptionally nutritious and healthy plant.

Sea buckthorn is resistant to drought (Heinze and Fiedler, 1981; Li and Shroeder, 1996), which makes it suitable to grow in dry areas such as western Mongolia. It prevents soil erosion (Cireasa, 1986) and mitigates desertification (Biswas and Biswas, 1980), reduces water loss in the soil, increases land reclamation (Balint et al., 1989), and creates habitat for wildlife species (Pearson and Rogers, 1962). Researchers agree that the above mentioned environmental values of sea buckthorn are thanks to its ‘extensive root system’ (Li and Shroeder, 1996). China has been planting sea buckthorn trees to successfully combat desertification since 1985 (Jianzhong et al., 2008; Li and Beveridge, 2003).

The literature reports that the nutraceutical food market is growing very fast. Nutraceutical food implies products that are a combination of nutritional supplement and pharmaceutical drugs. Sea buckthorn products fit into the nutraceutical food category because of their health benefits. In 1996, the nutraceutical world market was USD (\$) 86 billion (Nutrition Business Journal cited by Childs, 2000), and more recently it has reached \$182.6 billion in 2015 (Transparency Market Research, 2015).

There is very limited information on production of sea buckthorn, especially pertaining to the valuable berries, juice and oil; there are no statistics to be found even for sea buckthorn cosmetics and nutraceutical products. Nonetheless, markets for sea buckthorn products have been established in Asia and Europe (Storey et al., 2000). Jianzhong et al. (2008) stated that China has 2.7 million hectare of sea buckthorn cultivated land, the largest amount of sea buckthorn covered area in the world (more in Li and Beveridge, 2003). Jianzhong et al. (2008) also report that China has more than 100 sea buckthorn processing enterprises, and produces about 300 types of sea buckthorn products, with annual production reaching more than 10 billion RMB (\$1.43 billion⁹). This is likely, because most of the suppliers of sea buckthorn products that post on international trade websites, such as alibaba.com and zauba.com, are from China. Consequently, we may safely conclude that China is the biggest sea buckthorn producer and exporter in the world.

Storey et al. (2000) attempt to estimate the size of the sea buckthorn market in North America (Canada and US), which is the only economic and market research-based study of sea buckthorn. However, estimations were based on assumptions due to lack of primary and secondary data. Storey et al. (2000) claim that there is no market data available because the market is such a small niche. He added that private enterprises may have done some market analysis and collected data confidentially. However, these companies do not share their information and data.

Storey et al. (2000) estimated the potential market of sea buckthorn products based on assumptions. For example, Canada marketed 8 million litres of sea buckthorn beverage in 1996 (assuming 1% of the beverage market share). Secondly, Hartman and New Hope (1998, cited in Storey et al., 2000, p. 21) estimate the sea buckthorn tea market size of Canada as \$2.2 million for 1998, assuming that 13% of tea buying households are sea buckthorn tea consumers, one household purchases 2 times a year, and given the average tea price of \$2.50 (USD). Third, they estimate the sea buckthorn seed oil in Canada to be worth \$5.6 million, based on the assumption that sea buckthorn represents 1% of the market for essential fatty acid (Storey et al., 2000, p. 24). However, the price of sea buckthorn seed oil is much higher than that of flaxseed oil; thus this estimation is questionable (Storey et al., 2000)¹⁰.

The domestic and international prices of sea buckthorn are unknown and there are limited to no production statistics recorded, except at www.alibaba.com¹¹. Companies post independently set prices for their sea buckthorn products, but it is uncertain to what extent these prices are reliable or transferable between companies and regions. www.alibaba.com categorizes the sea buckthorn products as oil, berry and powder. As our study focuses on sea buckthorn berry, we are most interested in the prices for berry products. Berry price depends on the supplying continent, suppliers by country, whether the berries are

⁹ 1USD=6.95RMB, we calculated annual average exchange from daily data in 2008 from web site of State Administration of Foreign Exchange of China: http://www.safe.gov.cn/wps/portal/sy/tjsj_hljzj_inquire

¹⁰ Flaxseed oil is rich in Omega 3 fatty acid and representing market of essential fatty acid.

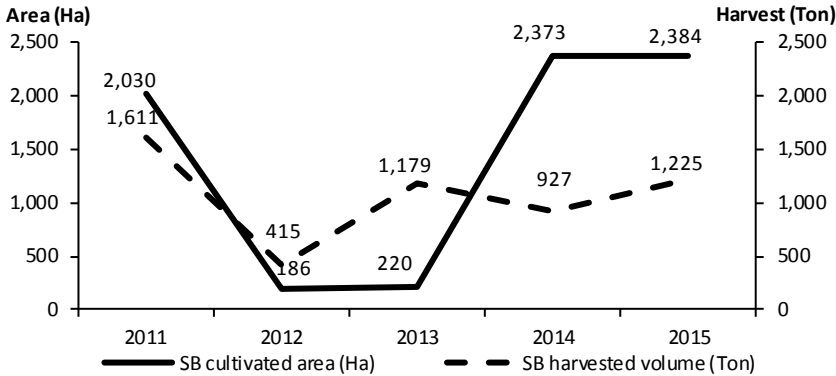
¹¹ http://www.alibaba.com/products/F0/sea_buckthorn_berries/CID21301-----50/1.html

dried or frozen, and part of a herbal or fruit extract. Some companies do not post their selling price. The variability in sea buckthorn pricing is a shortcoming creating uncertainty for analysis, because a researcher does not have a concrete source, but should rather spend time regularly keeping an eye on online prices. Additionally, the date of the offered selling price and date of advertisement is unknown.

Due to its extreme climate, fruits such as citrus, grapes and bananas cannot grow in Mongolia; instead sea buckthorn, apple, black currant and raspberry are commonly harvested. Mongolia harvested 1,412 tons of fruits, and sea buckthorn berry accounts for about 86.8% of this in 2015 (NSOM, 2016a, Appendix Figure 3). Hence, sea buckthorn berry is more than just a key fruit in Mongolia.

In Mongolia, sea buckthorn is a traditional fruit for human consumption; wild sea buckthorn has been grown for centuries in the country. With funding from the government, Oyungerel et al. (2015) studied the distribution of wild sea buckthorn in Mongolia in 2013 (Ministry of Food and Agriculture-MOFA, 2014, p. 7). Oyungerel et al. (2015) conclude that 43 forms of wild sea buckthorn cover about 13.5 thousand hectares of land in six provinces in Mongolia: *Selenge, Bulgan, Zavkhan, Gobi-Altai, Khovd* and *Uvs*.

Figure 9. The cultivated area and harvested volume of sea buckthorn berry in Mongolia

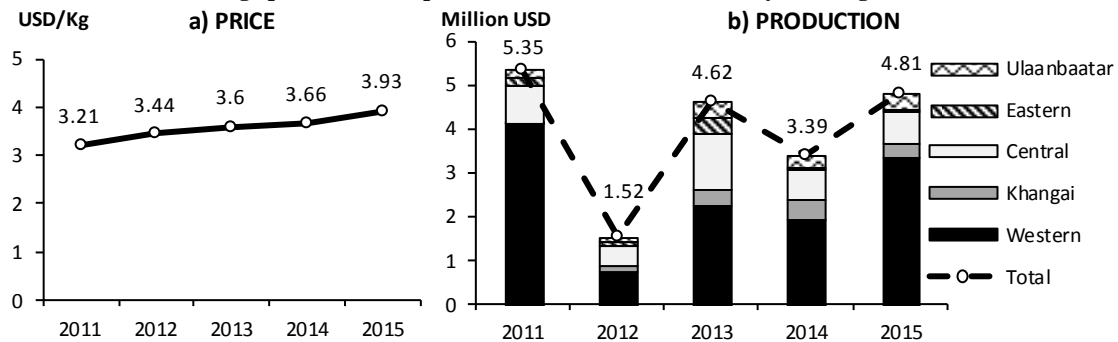


Source: National Statistical of Office of Mongolia (NSOM, 2016a)

Mongolia harvested about 1,225 tons of sea buckthorn in 2015, which is lower than the harvest of 2011 (National Statistical Office of Mongolia-NSOM, 2016a). Although cultivated area is generally increasing the trend does not seem very promising and stable as can be seen by the sharp decline in 2012 and 2013.

The NSOM (2016a) reports that *Uvs* province harvested 753.1 tons of sea buckthorn, which is 61.5% of the total harvest in Mongolia, in 2015. Furthermore, *Ulaanbaatar* city (7.9%), *Selenge* (6.4%), *Tuv* (6.1%), *Bayankhongor* (2.6%), *Bulgan* (2.6%), *Zavkhan* (2.3%), and *Khovd* (2.1%) provinces share 30% of the total production in Mongolia (Appendix Table 9).

Figure 10. The annual average price and total production of sea buckthorn berry in Mongolia



Source: NSOM (2016b) Unpublished price data (a); and Authors' estimation for production in million USD in b);

Note: The total production is estimated at harvested quantity multiplied by the national average price. The annual average exchange rate of 2012 is used for converting MNT to USD (1USD=1359.24MNT)

The domestic market price for sea buckthorn was about \$3.93 per Kg in 2015 and it has been increasing since 2011 with an annual average growth rate of 5.2% (Figure 10). Mongolia's sea buckthorn berry production was 4.8 million USD in 2015. Most of the production takes place in western Mongolia, dominated by *Uvs* province (Appendix Table 10).

3.4. Method and Data

'Competitiveness' has a broad meaning and therefore there is no universally accepted definition (Hatzichronoglou, 1996; Sharples, 1990). However, the general consensus among economists regarding the definition of competitiveness may be the definition of OECD reported by Hatzichronoglou (1996, p. 20), which is *"the ability of companies, industries, regions, nations or supranational regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis"*.

The PAM approach is a quantitative method to estimate profitability and competitiveness of a given production system. PAM starts with the profitability of production system in the private perspective. The private profit (D) is a result of revenue (A) minus costs of tradable inputs (B) and domestic factors (C) at market prices (Monke and Pearson, 1989, Appendix Table 1). A production system (or firm) is profitable if D is positive.

However, market prices do not illustrate the social benefit and cost of the production system, and other measurements are needed for social competitiveness. The formula remains the same, except that multiplying prices are social. Sometimes the social price is called as the shadow or economic price. Monke and Pearson (1989) suggest using export (import) prices as the social prices of exportable (importable) outputs and inputs. The idea is that if the output were to be sold on the international market the price the producer receives may be different from the domestic price. The implication for an output is that if the export or import price is higher than the domestic price, then the domestic consumers enjoy the cheaper price, but the producers suffer from the lower price. This may be due to government subsidy policies for consumers or taxes for producers. The inverse case is when the producers enjoy the higher price, due to government subsidy or import ban, but then the consumers pay high prices.

In the last row of PAM, the divergences of revenue (I), of tradable input costs (J), of domestic factor cost (K), and profit (L) are calculated. Divergences are the gap between revenue and costs multiplied by private and social prices. The bigger the divergences implies greater the market failure and stronger distorting policies, resulting in an inefficient the market outcome.

The divergences are numbers that are difficult to compare across different commodity systems, because the magnitudes and units of production and prices differ. Hence, analysts usually derive several ratios from the PAM for comparison of production systems.

Private cost ratio, $PCR=C/(A-B)$, implies ratio between cost of domestic factor and value added, in private prices (Monke and Pearson, 1989). Private firms try to minimize PCR by reducing B and C to maximize their profit. Domestic resource cost ratio, $DRC=G/(E-F)$, compares opportunity cost of domestic factors with its value added. It measures comparative advantage of the commodity. If $0 < DRC < 1$, then the domestic production is competitive because value added per commodity can cover incurred social cost of domestic input and remains profitable compared to border price (Gorton and Davidova, 2001). If $0 > DRC > 1$, then production is not competitive.

Alternatively, researchers use private (PCB) and social (SCB) cost benefit ratios. PCB (SCB) shows the competitiveness of the commodity from a private (social) perspective. The ratio is the sum of costs of tradable inputs and domestic factors in private (social) prices divided by total revenue of the good in private (social) prices ($PCB=(B+C)/A$; $SCB=(F+G)/E$). PCB and SCB never fall below zero. Hence, the value of them between zero and one indicates that the commodity is efficient and competitive. In other words, the costs are less than the benefits. If the ratios are higher than one then the commodity is not competitive, based on the perspective.

The DRC is sensitive to many variable inputs, especially the choice of the reference or border price for domestic factors, and exchange rates and international prices. DRC is also discontinuous at zero, and is sensitive to categorization of inputs whether domestic or tradable (Masters and Winter-Nelson, 1995; Nivievskiy and von Cramon-Taubadel, 2009). Thus, in our analysis we use PCB and SCB ratios.

PAM analysis is subject to some limitations. For example, most PAM analysts use national averages to estimate costs and revenues of a production system. However, averages cannot illustrate the best or worst practices and cannot judge in terms of statistical inferences (Morrison and Balcombe, 2002; von Cramon-Taubadel and Nivievskiy, 2008, 2009). Morrison and Balcombe (2002) propose re-sampling the input and output data with the bootstrap methodology developed by Efron and Tibshirani (1998) to increase reliability. This method draws the distribution of main indicators of competitiveness of PAM. Statistical inference using the confidence interval and standard deviation of those indicators can then be carried out (Morrison and Balcombe, 2002; von Cramon-Taubadel and Nivievskiy, 2009). Due to unavailability of farm level and disaggregated data, most PAM researchers use aggregated data. We adapt the methodological innovation of von Cramon-Taubadel and Nivievskiy (2008) to estimate distributions of competitiveness indicators in our study.

We surveyed 21 sea buckthorn farming households (HH) in *Bulgan* county in June 2014. We define a sea buckthorn farming HH as a HH that either plants sea buckthorn on their land, or owns (or ‘leases’) the land in which wild sea buckthorn exists. To generate two year panel data, we set sample selection

criterion as a HH having harvested sea buckthorn both in 2012 and 2013. *Bulgan* County Administration Office (2014) provided us with the list of 56 sea buckthorn farming HH. However, 26 of them did not harvest sea buckthorn in either 2012 or 2013. A further 9 HH were not available during our surveying period.

An average sea buckthorn farming HH has 4.6 (± 1.6) family members, where the average age of the HH head is 47 (± 11), and he/she received formal education for about 10 (± 2.4) years¹².

Although sea buckthorn has been harvested in the wild for centuries, sea buckthorn planting is a relatively new farming activity in Mongolia. Fifty-two percent of the HH that fences wild sea buckthorn areas has on average 16.3 years (min. 4 and max. 55) of experience in sea buckthorn farming. In contrast, an average HH that actively plants the sea buckthorn has about 5.5 years (min. 3 and max. 9) of experience in sea buckthorn farming. Based on this, we come to the conclusion that planting is comparatively new activity.

There are 13 HH that planted three types of sea buckthorn: wild (58%), Chinese (17%), and domestic varieties from *Uvs* and *Khovd* provinces (25%). The wild type is transplanted by the HH themselves; they take the younger seedlings with the root from naturally occurring areas and plant them in their own land.

An average HH harvested about 443.9 Kg (467.4 Kg) of sea buckthorn in 2012 (2013). However, there is a significant difference between the HH types. Based on the amount they harvest annually, we define a sea buckthorn farming household as small (below 99 Kg), medium (between 100 and 200 Kg) or large (above 201 Kg).

Table 13. Descriptive statistics of harvested volume and price of sea buckthorn berry in the sample

| Indicator | HH type | Obs. | 2012 | | | | 2013 | | | |
|--|--------------|-----------|--------------|--------------|------------|----------------|--------------|--------------|-------------|----------------|
| | | | Mean | \pm SD | Min | Max | Mean | \pm SD | Min | Max |
| Harvested volume of SB berry per HH (Kg) | Small | 8 | 27.1 | 14.7 | 7.0 | 50.0 | 30.6 | 9.4 | 15.0 | 40.0 |
| | Medium | 4 | 125.0 | 50.0 | 100.0 | 200.0 | 177.5 | 51.9 | 100.0 | 210.0 |
| | Large | 9 | 956.1 | 978.4 | 300.0 | 3,500.0 | 984.4 | 940.1 | 200.0 | 3,000.0 |
| | Total | 21 | 443.9 | 768.9 | 7.0 | 3,500.0 | 467.4 | 753.2 | 15.0 | 3,000.0 |
| Price per Kg of SB berry (\$) | Private | 21 | 3.1 | 0.6 | 1.8 | 4.4 | 3.3 | 0.6 | 2.2 | 4.4 |
| | Social | 21 | 2.8 | 0.5 | 1.7 | 4.1 | 3.0 | 0.5 | 2.0 | 4.0 |

Source: Authors' estimation

The average price of sea buckthorn berry was \$3.1 (\$3.3) per Kg in 2012 (2013), which is slightly lower than the national average (Figure 10). The estimated social price of sea buckthorn berry was \$2.8 (\$3.0) in 2012 (2013). We estimated social price as the private price multiplied by the 'Standard Conversion Factor' (SCF) by Squire and van der Tak (1975, p. 73). We estimate the SCF as 0.919 (0.914) for 2012 (2013), meaning that (when SCF is less than 1) the social price would be less than the domestic (Appendix Table 6).

We considered 22 types of inputs for sea buckthorn berry production, divided into non-tradable and tradable inputs (Appendix Table 11). The 'Capital recovery factor (crf)' is used to estimate the annual cost of non-tradable fixed inputs (Monke and Pearson, 1989, p. 104). The difference between the total

¹² Standard deviation in brackets

initial cost of the fixed input (Z) and the salvage value (S) is depreciated by the capital recovery factor (crf), which is the bracketed term of equation 1. This is used to obtain A , which is the ‘annual payment sufficient to repay’ the initial cost of a fixed input.

$$A = (Z - S) \left[\frac{(1 + i)^n i}{(1 + i)^n - 1} \right] \quad (1) \text{ adapted from Monke and Pearson (1989, p. 104)}$$

In equation (1), the interest rate (i) and useful life (n) of the input are the factors used to depreciate the cost to the present time period.

We take the annual average interest rate of Mongolia as the private interest rate (rate of return). These rates are 18.1% for 2012 and 18.5% for 2013 (World Bank, 2016). For the social interest rate, we choose the annual average interest rate of Georgia, because the GDP per capita of Georgia and Mongolia is close. Therefore, the social interest rates are 14.8% for 2012, and 13.6% for 2013 (World Bank, 2016). The assumption of the social interest rate employed in this study comes from Monke and Pearson (1989, p. 151). They justify this assumption in that a higher income country (measured by GDP per capita) could have a lower rate of return, but lower can have higher. Hence, an assumption can be made that if the two countries have similar economic performance then the rate of return of each country may reflect the social rate of return for each other. However, we acknowledge the weaknesses of this assumption that the GDP per capita is not the only measure to identify the county, but that alternatives may be agricultural GDP per capita or per hectare of agricultural land, human development index, economic growth rate etc.

The non-tradable fixed inputs include four types of inputs: investment cost of building irrigation canals, building fences, seedlings, and other inputs. We use relevant sources for useful lives and salvage values of the fixed inputs (Appendix Table 12). To estimate the social price of non-tradable intermediate inputs, we used the SCF.

Labour is a non-tradable intermediate input for sea buckthorn production, as there is limited to no access to the international labour market, assumed (Monke and Pearson, 1989). In vast rural areas like *Bulgan* county, there are limited job opportunities. The family labour is unpaid; thus, there is no salary data for sea buckthorn farmers. Hence, we assumed that the private price of the labour for sea buckthorn farming equals the national **poverty line** (NSOM, 2015d). The private salary per person per day (\$2.9 in 2012 and 2013) is converted by the SCF to estimate the social salary (\$2.66 in 2012, and \$2.67 in 2013)¹³.

The five types of tradable inputs identified for sea buckthorn production include: vehicle fuel, sugar, plastic bags, buckets, and gloves, which all imported from China (Appendix Table 11). The private prices of tradable inputs are the prices the farmers paid. We take NSOM price data for *Khovd* province to replace for missing values. For social prices, we use the estimated unit import price. The estimation is the total imports, in monetary terms, divided by the imported volume as reported by the Custom Agency of Mongolia (2015).

¹³ Estimation is based on the poverty line (118,490 MNT in 2012 per person per month) measured by months, which is then divided into 30 days to estimate the price of labour per person per day. 1€=1,359.24MNT, average exchange rate of 2012 reported by Central Bank of Mongolia (2015).

We asked Likert Scale type questions regarding the challenges of sea buckthorn berry farming during our survey. We identified seven types of challenges, and respondents were asked to reveal their level of agreement with each statement. Strongly disagree, disagree, neutral, agree, and strongly agree choices assigned to 1, 2, 3, 4, and 5 points respectively.

3.5. Results and Discussions

An average HH earned about \$1,384 (\$1,498) in 2012 (2013) from the private perspective (Table 14) from sea buckthorn berry farming. The private and social incomes differ significantly between HH types.

Table 14. Annual income of sea buckthorn berry production, by HH types (\$)

| Income | HH type | Obs. | 2012 | | | | 2013 | | | |
|---------|--------------|-----------|----------------|----------------|-------------|-----------------|----------------|----------------|-------------|----------------|
| | | | Mean | ±SD | Min | Max | Mean | ±SD | Min | Max |
| Private | Small | 8 | 90.3 | 54.9 | 21.6 | 176.6 | 106.2 | 40.1 | 49.2 | 176.6 |
| | Medium | 4 | 389.7 | 136.3 | 294.3 | 588.6 | 587.8 | 188.9 | 328.1 | 772.5 |
| | Large | 9 | 2,977.2 | 3,764.1 | 882.8 | 12,874.8 | 3,139.0 | 2,787.0 | 441.4 | 7,724.9 |
| | Total | 21 | 1,384.5 | 2,771.4 | 21.6 | 12,874.8 | 1,497.7 | 2,294.6 | 49.2 | 7,724.9 |
| Social | Small | 8 | 83.0 | 50.4 | 19.8 | 162.3 | 97.0 | 36.7 | 45.0 | 161.4 |
| | Medium | 4 | 358.2 | 125.3 | 270.4 | 540.9 | 537.3 | 172.7 | 299.9 | 706.1 |
| | Large | 9 | 2,736.0 | 3,459.2 | 811.3 | 11,832.0 | 2,869.1 | 2,547.3 | 403.5 | 7,060.6 |
| | Total | 21 | 1,272.4 | 2,546.9 | 19.8 | 11,832.0 | 1,368.9 | 2,097.3 | 45.0 | 7,060.6 |

Source: Authors' estimation

From the social perspective, an average HH earned about \$1,272 (\$1,369) in 2012 (2013). The social income is slightly lower than the private, which is due to the SCF is being below 1. The lower social price means that the domestic producers are supported by government policies. However, the largest sea buckthorn berry producer, China, may have higher government subsidies for sea buckthorn berry production (Jianzhong et al., 2008); hence the Chinese export price (social price for Mongolia) is likely lower than Mongolian domestic price. In other words, our result intuitively reflects the fact that the international (social) price is lower than the domestic (private) price.

Table 15. Annual cost of sea buckthorn berry production (\$)

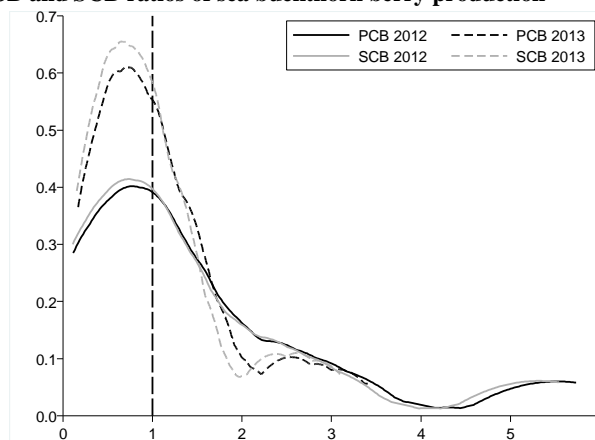
| Cost type | 2012 | | | | 2013 | | | |
|------------------|-------------------|-------------------|------------------|-------------------|--------------------|--------------------|------------------|-------------------|
| | Private | | Social | | Private | | Social | |
| | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) |
| Fixed input | 406±906 | (19-3,929) | 339±751 | (17-3,255) | 415±925 | (20-4,011) | 315±695 | (16-3,015) |
| Domestic Capital | 274±972 | (0-4,429) | 251±893 | (0-4,070) | 273±979 | (0-4,458) | 249±895 | (0-4,075) |
| Factor Labour | 298±283 | (17-935) | 274±260 | (15-859) | 355±418 | (21-1,555) | 324±383 | (20-1,421) |
| Land | 68±113 | (0-471) | 62±104 | (0-433) | 68±113 | (0-471) | 62±103 | (0-430) |
| Tradable input | 45±87 | (0-317) | 29±55 | (0-197) | 65±155 | (0-666) | 34±70 | (0-243) |
| Total | 1,091±2151 | (57-9,768) | 956±1,894 | (51-8,619) | 1,175±2,352 | (63-10,510) | 984±1,992 | (53-8,949) |

Source: Authors' estimation

An average HH spent about \$1,091 (\$1,175) in 2012 (2013) per year for sea buckthorn berry production, from the private perspective.

We estimated the PCB and SCB ratios for each sea buckthorn berry farming HH. Figure 11 shows the Kernel distribution of the PCB and SCB ratios. The estimated density points depicted between 0 and 1 show the distribution of competitive HH, and more than 1 reflects non-competitive HH.

Figure 11. Kernel density of PCB and SCB ratios of sea buckthorn berry production



Source: Authors' estimation

The distribution is left skewed, with a long tail to the right, suggesting that there are HH that are operating far from being competitive. The divergence between private and social competitiveness, based on PCB and SCB ratio distributions, is minor. Generally, the competitiveness level has increased from 2012 to 2013.

Nivievskiy and von Cramon-Taubadel (2009) introduced three types of proportions to analyse the competitiveness level of production systems. Firstly, the proportion to total production volume (PTP) measures the percentage of production volume produced by competitive or non-competitive HH. Secondly, proportion to total number of farmers (PTF) measures the percentage of households there are competitive or non-competitive in the total sample. Thirdly, proportion to total output value (PTOV) measures the percentage of total income generated by competitive or non-competitive households.

Table 16. PCB and SCB ratios

| Proportions | 2012 | | | | Average | | 2013 | | | | Average | |
|-------------|---------|-------|---------|-------|---------|-----|---------|-------|---------|-------|---------|-----|
| | PCB | | SCB | | PCB | SCB | PCB | | SCB | | PCB | SCB |
| | 0<PCB<1 | PCB>1 | 0<SCB<1 | SCB>1 | | | 0<PCB<1 | PCB>1 | 0<SCB<1 | SCB>1 | | |
| PTP | 80.4% | 19.6% | 81.5% | 18.5% | 1.6 | 1.5 | 61.0% | 39.0% | 63.5% | 36.5% | 1.1 | 1.0 |
| PTF | 47.6% | 52.4% | 52.4% | 47.6% | | | 52.4% | 47.6% | 61.9% | 38.1% | | |
| PTOV | 84.3% | 15.7% | 85.3% | 14.7% | | | 66.2% | 33.8% | 68.9% | 31.1% | | |

Source: Authors' estimation

Note: PTP-Proportion to total production volume; PTF-Proportion to total number of farmers; PTOV-Proportion to total output value or total income (Nivievskiy and von Cramon-Taubadel, 2009)

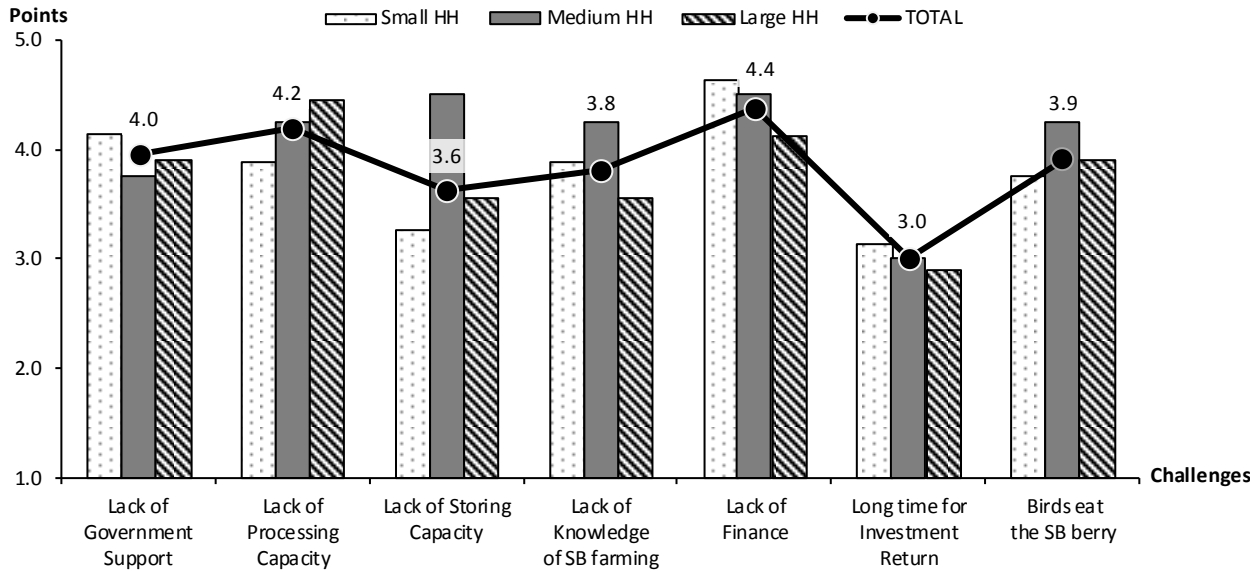
Table 16 shows that average PCB and SCB ratios are above 1, which suggests that, on average, the sea buckthorn berry production system is not competitive in 2012. However, the situation improved in 2013. However, an average indicator cannot show the detailed information of how many of the households are non-competitive (Nivievskiy and von Cramon-Taubadel, 2009). In fact, 47.6% (52.4%) of the HH were privately competitive or profitable in 2012 (2013). About 80.4% (61.0%) of the total production volume has been produced by privately competitive households in 2012 (2013). According to the PTOV, 84.3% (66.2%) of total income has been generated by privately competitive HH in 2012 (2013).

Competitiveness differs between the private and social perspectives only slightly, which is due to the fact that the gap between private and social prices of the output (inputs) is minimal. Overall, the private competitiveness level is lower than the social one for both years and for both three proportions (Table 16); private price is higher than the social price (Table 13). This suggests that domestic producers are charging higher prices from consumers, which is mostly due to import restrictions and tariff policies (Monke and Pearson, 1989). On the other hand, the private input prices are even higher than the social input prices. It means that the domestic producers are encountering the disadvantage of having higher costs of production against international prices. For instance, it could be the case that neighbouring countries like China, experience an advantage of low labour costs (Ceglowski and Golub, 2012), and subsidy-based policy for sea buckthorn farmers (Jianzhong et al., 2008). The implications are that, the sea buckthorn berry price is protected (or supported), however the prices of inputs to produce the sea buckthorn is also protected, even more. Hence, the private sea buckthorn farmers are in need of support to decrease the input costs (e.g., interest rate and vehicle fuel etc.) for production to improve private competitiveness. In social point of view, eliminating all price distortions (subsidies or supports) would be recommendable policy option. Consequently, the consumers will not be suffering from high price, and producers will not be dragged down by high costs of inputs.

Both the private and social competitiveness levels have increased, which may be traced to the implementation of the “Sea Buckthorn National Programme (SBNP)”, a crucial policy of Government of Mongolia (2010) supporting the sea buckthorn industry. The duration of SBNP is from 2010 to 2016, and the government had spent 19.3 billion MNT (\$10.6 million) by the end of 2014 (MOFA, 2015, p. 21). About one third of the funding from SBNP is spent for production and distribution of sea buckthorn seedlings. Furthermore, SBNP funds the establishment of sea buckthorn processing factories, building irrigation systems, a plantation station for seedlings, conducting research, trainings and advocacy etc. MOFA (2015) states that from 2010-2014 SBNP enabled 6.4 million sea buckthorn seedlings to be prepared and distributed, employed 6,048 people, and protected 20 thousand hectare of land from desertification. SBNP might have a positive impact on improving the competitiveness. As our analysis shows, the competitiveness level of sea buckthorn berry production increased within the two years of study. The reasons of the increase are due to increased harvest volume and an increased sea buckthorn berry price. However, the cost of the production also increased. Consequently, income growth was higher than the cost, which results to an increase in the competitiveness level.

About half of the sea buckthorn farming HH is not competitive from both the private and social perspective in our sample. The HH are threatened by numerous challenges associated with sea buckthorn farming.

Figure 12. Challenges for sea buckthorn berry farming, by household type



Source: Authors' estimation

Note: In vertical axis, 1, 2, 3, 4 and 5 indicate strongly disagree, disagree, neutral, agree, strongly agree respectively; SB –sea buckthorn;

We estimated the mean of the assigned points of seven types of challenges, depicted in Figure 12. Overall, the most common challenge is **lack of finance** which is the most serious challenge for small sea buckthorn farming HH. This is supported by our analysis that 37.2% (35.3%) of total private costs is composed of fixed input costs (Table 15). The **lack of processing capacity** becomes a secondary challenge. It is the most serious challenge for the large HH. This can be related to the fact that large HH harvest much higher volumes. If there were a processing facility in the region, then the berry price can be higher or transportation and storage costs could be lower than the current level. Some HH complain about the **birds** that eat the sea buckthorn berry, which often reduces the harvest volume and increases costs for materials to protect sea buckthorn from the birds.

3.6. Conclusions

Sea buckthorn has rarely been studied from an economic perspective; although it has been studied in fields of natural and medicinal sciences. Sea buckthorn produces multiple outputs for nutraceutical and pharmaceutical human consumption. In Mongolia, planting sea buckthorn is a new way of farming, contrasted to the traditional way of harvesting the berries from wild sea buckthorn trees in nature.

We find that about half of the sea buckthorn berry farming households is operating competitively, both from the private and social perspective. Lacking experience in sea buckthorn farming is likely, as the average experience of a sea buckthorn plantation is 5.5 years. Furthermore, about 60-80 percent of the sea buckthorn berry volume is produced by privately competitive farmers. The critical challenge for the sea buckthorn berry farming households is the lack of finance, which is the most serious problem for small households. As secondary challenges include, lack of sea buckthorn berry processing capacity and birds that eat the sea buckthorn before harvest.

The private competitiveness level of sea buckthorn berry is lower than the social one. The output (sea buckthorn berry) prices are high due to government support policies; however the input prices are also and even more distorted. Consequently, the private producers face losses in profitability. To improve the private competitiveness, the policies should focus towards decreasing the input costs. To improve social competitiveness, price supports both for inputs and output should be eliminated, so that the consumers will not suffer from high output price and farmers will not be burdened with high input costs.

The growth of sea buckthorn planting area and harvested volume might be due to Sea Buckthorn National Programme, initiated in 2010. Our results also reveal that the production increased among interviewed households from 2012 to 2013. Both private and social competitiveness level of sea buckthorn farming increased among the farmers over this time period as well.

4. OVERALL DISCUSSION AND FUTURE RESEARCH DEVELOPMENTS

4.1. Main results and discussions

4.1.1. Essay 1: The competitiveness of pastoral livestock production

This essay aims to fill the research gap on whether or not pastoral livestock production is competitive in the private and social perspectives in Mongolia.

On average, a herder household earns private and social income that does not cover the cost of livestock production. Ninety percent of the total income originates from goat and cattle production; hence, these are the key livestock types in Mongolia for earning incomes. In 2011 (2012), cow milk (26% (25%)), goat cashmere (23% (17%)), goat meat (21% (28%)), and cattle meat (12% (14%)) contributed to 82% (84%) of the total income.

Labour shares about 52.4% of the total cost and indicates that the livestock production in Mongolia is labour intensive. If the labour is valued as zero, then the goat becomes the most privately profitable livestock. On the contrary, when the labour is valued at the poverty line, then cattle is the most profitable livestock. This is because cattle do not require constant labour for rearing and herding, because they graze the pasture in the morning and come back in the evening by themselves, unlike goats and sheep.

Cost of pastureland accounts for about 3.6% of the total social costs in both years. This may be due to our assumption of how we estimate pastureland cost. We take the 500 MNT per taxed sheep unit (TSU), as proposed in the “Asset tax law” proposal by the Government of Mongolia (2014b). The proposal suggests a tax amount ranging from zero to 1000 MNT per TSU, which is likely to be politically motivated. Having a zero tax can be explained in that politicians are reluctant to levy taxes on herder communities, as these communities have strong voting power. Secondly, the year 2011 and 2012 were just after the heavy *Dzud* in 2010. In other words, livestock loss was quite high and the number of livestock to be taxed was reduced. Hence, the fewer livestock reduces the total cost of tax, which is supposed to reflect the cost of the land. This can be intuitive as Dietz et al. (2005, p. 3) found that there is an over use of the pastureland beyond its carrying capacity before a *Dzud*, but after a *Dzud*, environmental regeneration occurs when livestock numbers are below the carrying capacity. Hence, land costs share a smaller portion of the total social cost just after a *Dzud*. If the cost of land use per TSU becomes more than 5,000 MNT, then the land cost share becomes more than one third, and social competitiveness level significantly reduces. When the land cost reaches to 11,048 MNT per TSU, then share of socially competitive HH becomes 58%, instead of 90.1% where land use cost is 500 MNT per TSU.

The most competitive output, from the social perspective, is cow milk. This is an intuitive result because cow milk is an important food source for rural households. Herders are not able to sell the raw milk on central markets due to lacking infrastructure, long distances, and therefore high transportation costs. However, it is possible to transform the milk into dairy products like dried curd and classified butter, which makes it easy to store and transport.

The least competitive output, from the private perspective, is horsehair & tail for both years. The least competitive outputs, from the social perspective, are horsehair & tail in 2011 and sheep hide in 2012.

The most competitive livestock type is cattle in both private and social perspectives. In terms of share of competitive HH, 95.2% (91.0%) of HH who raised cattle are privately competitive, and 98.8% (97.0%) are socially competitive in 2011 (2012). The livestock herding labour required is comparatively lower for large livestock (cattle, horses and camels) than small livestock (goats and sheep). Hence, cattle has a labour cost advantage compared to goats and sheep.

Horses are the least competitive livestock among the five types of livestock. However, around one third of horse herders are competitive in both the private and social perspectives. The key for being competitive at horse farming is to slaughter the horse for meat and hide production simultaneously. Competitive horse farmers produced about 97.2% (94.2%) of the total production volume of horse meat and hide in 2011 (2012). Nonetheless, horses are a kind of input for production. For example, horses are required to herd all other types of livestock and for transportation. In addition, herders enjoy horse racing as a part of their culture. Horses give the herders cultural and spiritual benefits from being a nomadic herder. Hence, it is reasonable that the horse is ranked as the lowest in competitiveness for producing economic outputs, as the intrinsic value of the horse is difficult to take into account with our approach. To some extent, the situation for camels is similar.

With the exception of the horse, the production systems of each livestock type are competitive from the private perspective, given that more than 70% of the households operate competitively for each type of livestock. The cattle and goats are more socially competitive than privately, as is indicated through the higher share of socially competitive HH. This may be due to inefficient supportive policies, like the ‘Mongol livestock Policy’ national programme (Parliament of Mongolia, 2010). The herders’ free use of the pastureland, cheap hay and fodder when a *Dzud* approaches, livestock watering wells installed and maintained, and free livestock vaccinations are the examples of livestock supportive policies (Lecraw et al., 2005).

Over the entire sample, 91.5% (83.0%) of households are privately and 92.6% (87.5%) are socially competitive in 2011 (2012). The share of privately competitive households is less than socially competitive ones. One of the reasons can be that the private interest rate is higher than the social one, which increases the cost of capital. The competitiveness level is positively correlated to the number of livestock at each household level. Having all five types of livestock is common practice. The share of privately competitive households and number of livestock are highest for HH that keep all five types of livestock.

The better (worse) households are consistently better (worse) for the two years. Thus, there is a systematic difference between better and worse households. Hence, we reveal that our analysis catches the robust implications for HH competitiveness over two years. The most competitive HH have significantly higher number of livestock, less rate of loss during *Dzud*, keep more cattle, and have less mobility cost per SHU; and head of the HH is older and tend to be non-*Kazakh*, compared to the least competitive HH. Poorer HH tend to move more often and have higher mobility cost per SHU; because, they have no secure seasonal campsites, and use other’s land (Fernandez-Gimenez and Batbuyan, 2004). The other reason is that, poor/remote HH move often as a strategy to induce livestock weight gain unless it is affordable to buy fodder (or hay) from the market (Addison and Brown, 2014). Our contribution to

the literature is that the most competitive HH tend to move by camel more, which reduces the fuel cost of seasonal movement, where the fuel cost shares a large component of the total mobility cost.

4.1.2. Essay 2: The competitiveness of sea buckthorn farming

Sea buckthorn and its outputs are rarely studied from an economic perspective. The berries of sea buckthorn give multiple outputs that are healthy. However, whether or not sea buckthorn berry farming is competitive in the private and social perspectives is unknown throughout the literature.

Average PCB and SCB ratios are higher than one for sea buckthorn berry production. This means that the sea buckthorn berry production cannot cover the costs, on average. However, an average indicator cannot show the detailed information of how many of the households are non-competitive (Nivievskiy and von Cramon-Taubadel, 2009). In fact, 47.6% (52.4%) of the sea buckthorn farming HH are privately competitive or profitable in 2012 (2013). About 80.4% (61.0%) of the total production volume has been produced by privately competitive households in 2012 (2013). For the total private income, 84.3% (66.2%) of total income has been generated by competitive HH in 2012 (2013).

Private competitiveness level is lower than the social one in both years. One of the reasons is that the private output price is higher than the social price. This already suggests that domestic producers are charging higher prices from the consumers, which is mostly due to import restrictions and tariff policies (Monke and Pearson, 1989). Contributing to this is that the private input prices are governmentally supported so that they are even higher than the output price, which is also supported. This means that the domestic producers are encountering a disadvantage of having a high cost of production. This could be caused by the neighbouring countries like China, which has an advantage of low labour costs (Ceglowski and Golub, 2012). The output (sea buckthorn berry) price is high in Mongolia due to government support policies; however the prices of inputs outstrip the output price. Consequently, the private producers encounter a low level of profitability. Hence, to improve the private competitiveness, the policies should focus towards decreasing the costs of inputs of the production system, for example interest rate, price of vehicle fuel etc.

The competitiveness level increased between 2012 and 2013 in our sample. The reasons of the increase are due to an increase in harvested volume and an output price increase for sea buckthorn. However, the cost of the production also increased. Nonetheless, income growth was higher than the cost, which results in the increase in the competitiveness level. The increase might be due to the “Sea buckthorn National Programme (SBNP)”, a crucial supportive policy approved by the Government of Mongolia (2010). The government spent 19.3 billion MNT (\$10.6 million) by the end of 2014 (MOFA, 2015, p. 21) on this programme. MOFA (2015) states that the programme prepared and distributed 6.4 millions of sea buckthorn seedlings, employed 6,048 people, and protected 20 thousand hectare of land from desertification under SBNP in 2010-2014.

About half of the sea buckthorn farming HH are non-competitive in both the private and social perspectives in the sample, and are overwhelmed with challenges. The most common challenge is **lack of finance**, which is the most serious challenge for small sea buckthorn farming HH. This is supported by our analysis that 37.2% (35.3%) of total private costs are from fixed input (investment) costs. The **lack of processing capacity** becomes a secondary challenge. It is the most serious challenge for the large HH.

This can be related to the fact that large HH harvest much greater volumes of berry, and if there is a processing factory in the region then the transportation and storage costs could be lower than the current level. Some HH complain about the **birds** that eat the sea buckthorn berry, which often reduces the harvest volume and increases costs put towards protecting the harvest from birds.

4.2. Policy implications and options

4.2.1. Essay 1: The competitiveness of pastoral livestock production

In order to raise the level of competitiveness of livestock production in Mongolia, we recommend the following policy options.

- 1. Increase livestock productivity for meat, milk and hair outputs.** A productivity increase can be induced by a lower number of livestock, but with more output per livestock, and/or through the reduction in livestock production costs (especially labour) and pastureland degradation. One solution could be to slaughter the livestock (excluding calving females) at younger than five years of age. There is a continuously repeated claim that HH keep the livestock until they are very old. Another way is to improve the breeding management by improving breeding selection.
- 2. Increase meat export.** We recommend the following policy options for increasing meat exports:
 - Improve veterinary services with effective monitoring and evaluations system;
 - Negotiate with the Russian and Chinese governments, and further with Kazakhstan and Japan on issues regarding trade restrictions, and easy movement of products between countries;
 - Institute a livestock ear tagging system for disease control starting with the previous 3-5 generations of livestock to guarantee that livestock is non-diseased;
 - Announce and certify the non-diseased territories, including counties and provinces, with help from World Organization for Animal Health;
- 3. Support a social security system for herders.** As concluded in our study, labour is the most important input for livestock production and policies should enhance rural social services including health, education, and infrastructure. About, 10% of herders pay social insurance in Mongolia (Social Insurance General Office of Mongolia, 2015). Thus, many herders cannot benefit from the state social security system; hence, the risk of dropping into poverty is higher for herding communities. In addition, occupational safety training for herders through TV programmes to reduce injuries, fatalities, especially during *Dzud* etc., and training programmes for child safety as a part of herding labour should also be introduced in educational programmes.
- 4. Support reduction of herding labour.** Herding (or rearing or shepherding) labour shares the highest proportion of total labour costs. One way to reduce the herding labour is to herd the livestock by communal or group of households, not by individual households. There, schedule of labour sharing, responsibility of herding should be institutionalized. This is especially useful for herding goats and sheep.

5. **Implement pastureland tax policy.** The livestock tax policy should be approved and implemented, but the tax rate should be sensitive to the type of livestock (e.g. one goat is taxed twice as much as one sheep as proposed by the Government of Mongolia, 2014b), location, and age of the livestock. Tax policy for livestock production will require a formal and verifiable livestock registration system. Currently, an official statistics account is based on an interview where livestock number per household is self-reported, which can only be true when the herders report the true number of livestock. If the livestock tax law per livestock is approved and implemented thoroughly with a reliable registration system, then Mongolia may have more accurate estimates of the number of livestock. The Government of Mongolia (2014b) proposed to have tax exemptions in the livestock tax law proposal, but the criteria of the exemptions are ambiguous. This should be corrected or no exemptions should be enacted on the tax law, because the tax rate is interval based. The minimum tax rate is zero, and it could substitute as the exemption. An ear tagging policy should be employed together with livestock tax policies for transparent accountability purposes. Furthermore, the tax payment receipt must equate the official document of collateral for bank loan applications for herders.
6. **Support domestic dairy consumption.** For milk produced in remote areas like *Bulgan* county, the only solution to storing products longer and to transporting them easily is to make dairy products, e.g., dried curd, clarified butter and fermented vodka etc. One way of improving competitiveness of dairy production is to encourage the domestic consumption of these products among the population, especially young generations.

4.2.2. Essay 2: The competitiveness of sea buckthorn farming

We recommend the following policy options for improving the level of competitiveness of the sea buckthorn farming system in Mongolia.

1. **Building infrastructure to reduce investment cost of sea buckthorn farming.** Sea buckthorn farming is not highly competitive in Mongolia as is shown by the result that half of the farmers are non-competitive and level of private competitiveness is lower than the social one. The main reason is that the cost of the sea buckthorn farming burdens the competitiveness. To be precise, investment cost shares the highest proportion of the total cost. One policy option could be to build irrigation canals for sea buckthorn farming areas, distribution of seedlings with highly productive varieties from *Uvs* (name of province where 61.5% of Mongolian sea buckthorn is harvested) and China.
2. **Financial support for sea buckthorn farmers.** The largest challenge for sea buckthorn farming is lack of finance, which is especially the case for the small farmers who harvest less than 99 Kg of sea buckthorn berry per year. One policy option to cope with this shortage would be government loans with low interest rates and which require little to no capital for attainment by farmers. However, care should be taken to include cohesive monitoring and evaluation systems and comprehensive policy implementation plans.

3. **Support companies that process the sea buckthorn berry.** In remote areas, like *Bulgan* county, sea buckthorn berry processing capacity is lower than in central Mongolian areas. Sea buckthorn berry harvest volumes may increase if there is enough processing capacities in local areas. Primary processed sea buckthorn berries could be transferred to further processing factories where end products could be manufactured. Therefore, one policy option would be to support creating new or expanding former sea buckthorn berry processing factories, and small and medium scale workshops in the counties. This policy would increase production and employ more people, and increase income for local farmers. It would also reduce the cost of transportation of the berry to central areas where processing factories exist.
4. **Support the functional trainings of sea buckthorn farming.** We reveal that there is too little experience with sea buckthorn farming amongst the interviewed households. The households stress that at every stage of the process, sea buckthorn farming requires specific knowledge – from choosing the right sort of seedlings, to storing and selling the sea buckthorn berries on the market.

4.3. Future research developments

We focus on the competitiveness of livestock production and sea buckthorn berries, as two of the predominant agricultural economic opportunities available in the case study region. Using the Policy Analysis Matrix approach based on disaggregated farm level data is an effective way to estimate competitiveness; however, we acknowledge the limitations of our study. The limitations are described as follows. **First**, the assumption of splitting the common cost into each output is undertaken by an assumption. The assumption is that the share of the income for a specific output is used to split the cost to that output. This may be the reason that goat has a higher share of common cost, like labour of herding, because goat shares a higher share of income. **Second**, the study only focuses on one county; however there are 330 counties in Mongolia. One may argue that only one county cannot represent whole pastoral livestock production system of Mongolia, because different areas have different settings. **Third**, the competitiveness between livestock type may not represent the full benefits of each livestock type in our analysis. For example, horses provide the benefits of not only producing meat, milk, hide and hair&tail, but are also an input for herding or rearing the livestock, transportation, and have intrinsic and spiritual value of being for nomadic herders. **Fourth**, the number of observations were too few (less than 20) for milk of sheep, horse and camel, and meat and hide of camel. Hence, comparison of level of competitiveness for these five types of output could not be made. We would require a greater sample size for analysing them. **Fifth**, the social price of sea buckthorn berry is not the export or import price because in the case of Mongolia there is no such data. Hence we converted the domestic output price using the standard conversion factor. This may contradict with the Policy Analysis Matrix approach, because the real export or import price may be different than our estimated price.

To overcome the limitations of the studies aforementioned, and to advance research into the future, the following should be dealt with:

- Any production system is dynamic, especially the pastoral livestock production system in Mongolia where the system is dependent on natural climatic conditions and human interactions. Our analysis accounts data of 2011 and 2012, right after a *Dzud* in 2009-2010. Hence, the implications of our study may be limited to years when the livestock number has suddenly been reduced because of *Dzud*. Hence, further research should focus on multiple year effects based on long-term panel data which includes years leading up to a *Dzud*, during a *Dzud*, and after a *Dzud*.
- It is important to replicate this study in different areas to improve the understanding of the competitiveness of the Mongolia system as a whole. The next step of comparison can be in different parts of Mongolia or any other country where pastoral livestock husbandry exists. Then, the comparison of competitiveness of production systems and differences could possibly be made clearer, which in turn validates the study results in this dissertation.
- It would be interesting to analyse the state of efficiency level for each of the products. The potential research questions could be: How resources or inputs are used to produce livestock outputs? Which output is more efficient than the others? What are the reasons for different levels of efficiencies?
- Valuing the pastureland as an input for pastoral livestock production should remain a relevant and complex research interest. In our study, we used a livestock tax rate proposed by the Government of Mongolia, which may not be the true value of the pastureland. Therefore, the valuation should be done based on indexes of natural and socio-economic indicators of the region, with appropriate valuation techniques developed in environmental economics. These methods may even be useful in enlightening the proposed tax rate.
- This dissertation contains a unique economic study on sea buckthorn berry farming, which is a good start to analysing the market and competitiveness of this plant. Nonetheless, further research is needed to understand the profound foundations of the competitiveness for sea buckthorn. The competitiveness surely differs across regions, plant varieties, and over time.

5. CONCLUSIONS

The analysis presented in chapter 2 leads us to the following conclusions. Pastoral livestock husbandry is competitive from both the private and social perspectives, and cattle is the most competitive livestock in Mongolia. Ninety-one percent (83.0%) of households were privately and 92.6% (87.5%) were socially competitive in 2011 (2012). HH that have larger numbers of livestock tend to have more types of livestock and make up a high share of the competitive HH.

Pastoral livestock production is one of the key sectors in rural Mongolia. However, the increasing number of livestock exceeds the carrying capacity of the land and is becoming problematic. Herders keep goats more than other types of livestock because of its valuable cashmere. Despite concerns that this might be leading to serious degradation, we find that pastureland costs have only a limited effect on social competitiveness. It could be the case that better grassland valuation techniques are needed. Our results confirm that cashmere provides the second highest (after cow milk) private income. Nevertheless, cashmere (goat) is not the most competitive output (livestock type) from both the private and social perspectives in the case of pastoral livestock production in Mongolia.

We find that cattle are the most competitive livestock type. First, labour costs are much smaller for cattle than for goats and sheep. Second, although cow milk does not receive high prices, but it secures the food nutritional needs of the rural communities. In our research, we find that the cow milk is the most socially competitive output. The most competitive HH have significantly larger numbers of livestock and keep more cattle; thus they earn the majority of their income from cattle. They also have lower livestock mortality rates during a *Dzud* than less competitive HH. The least competitive HH earn 61.3% of their total income from goats, and spend 67.8% of their total cost for goats. On the contrary, for the most competitive HH income and cost shares are concentrated on cattle farming. The most competitive HH tend to be less mobile and their mobility costs per livestock (sheep unit) are significantly smaller. The fuel cost of mobility is crucial; hence moving by camel reduces total mobility cost significantly. For the most competitive HH, the share of HH that use camel for seasonal movement is 15% higher than for the least competitive HH. We conclude that the number of livestock and number of types of livestock are positively correlated (correlation coefficient 0.41 for pooled data). Furthermore, HH who keep more types of livestock tend to be more privately competitive.

We acknowledge the shortcomings of this study. First, the assumption of proportional input cost allocation to outputs (Horngren et al., 2012, p. 580) likely does not reflect the true allocation. The higher the (private) income share for an output, the higher the cost allocated to that output. As a result, meat, hide and milk production from camel are likely allocated costs that are too low because income from these products is minor compared to, e.g., goat cashmere and cow milk etc. Furthermore, more research is needed on estimate social costs of pastureland use, to adequately account for environmental and socio-economic costs.

This thesis provides a first detailed economic analysis of the pastoral livestock system and benchmarks whether the system is competitive. We conclude that the system is competitive, but not for all the livestock types and outputs. Although, the literature claims that the cashmere is the maximum income

earning output, we find it to be cow milk. For both private and social perspectives, a cattle is the most competitive livestock type.

In the second paper on sea buckthorn production, we generate the following conclusions. Sea buckthorn is a rarely economically studied product, although it has been studied in fields of natural and medicinal sciences. The sea buckthorn generates multiple outputs of nutraceuticals and pharmaceuticals for human consumption. In Mongolia, planting sea buckthorn is a new way of farming, contrasting to the traditional way of harvesting the berries from wild sea buckthorn trees in nature.

We find that only about half of the sea buckthorn berry farming households is operating competitively both in the private and social perspectives. The low competitiveness level is likely due to lack of experience of sea buckthorn farming, given that the average experience of sea buckthorn farming is 5.5 years. Furthermore, about 60%-80% of the sea buckthorn berry volume is produced by privately competitive farmers. Survey results indicate that the critical challenge for households that farm sea buckthorn is the lack of finance, which is the most serious problem for small households. Secondary challenges include the lack of sea buckthorn berry processing capacity, and birds that eat the sea buckthorn berry before harvest.

Private competitiveness level is slightly lower than the social competitiveness level. The domestic price of sea buckthorn berry is higher than the international price. However, domestic input prices are even higher than the social input prices. Hence, policy should be directed to reduce the input costs of the production, for example interest rate, price of vehicle fuel etc. To improve social competitiveness, price supports both for inputs and output (sea buckthorn berry) should be eliminated, so that the consumers will not suffer from high output price and farmers will not be burdened with high input costs.

The growth in sea buckthorn cultivated area and harvested volume might be due to the government's 'Sea Buckthorn National Programme', started in 2010. We find that the interviewed households increased their production and profitability from 2012 to 2013. Both the private and social competitiveness level of sea buckthorn farming increased among the farmers. This could imply that the sea buckthorn berry farming will continue to increase in competitiveness in the years to come.

In conclusion, we find that the pastoral livestock production in the study region is privately and socially competitive. Unfortunately, this is not the case for sea buckthorn farming. Nonetheless, competitiveness can be improved in both cases. Pastoralists can increase their competitiveness by reducing the numbers of goats, and increasing their cattle herds, because goats are less competitive than cattle and the most competitive households keep more cattle than goats. Reducing the labour input for livestock production may also help to improve competitiveness. Estimated pastureland costs seem to have little effect on total cost; however land degradation is still a problem for herding communities, which is mostly due to the increasing number of goats and more comprehensive approach is needed for estimating the social costs of the pastureland use. The main reasons for the low level competitiveness of sea buckthorn berry farming are lack of experience, and a high cost of farming especially investment costs. The farmers express the biggest challenges as lack of finance and lack of processing capacity in local areas. To improve the private competitiveness of the sea buckthorn farming, government should focus on reducing the input costs. To improve social competitiveness, price supports both for inputs and output should be eliminated,

so that the consumers will not be suffering from high output price and farmers will not be burdened with high input costs. This study shows that there are many possibilities to increase the competitiveness of the pastoral livestock and sea buckthorn berry farming as a part of the greater agricultural sector in Mongolia.

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7. APPENDIXES

Appendix 1. Method and data of Essay 1

Appendix Table 1. Policy Analysis Matrix

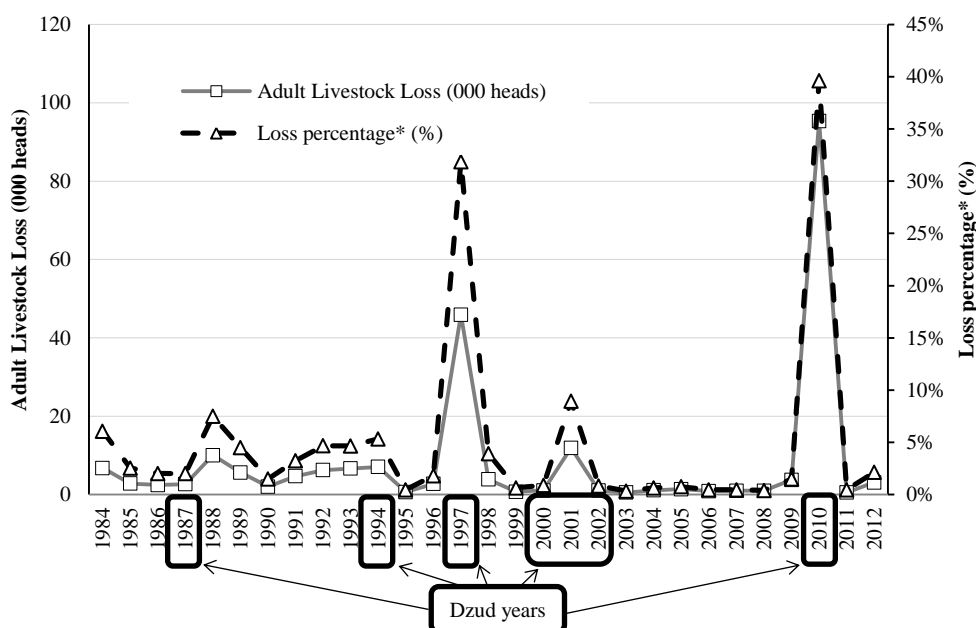
| | Revenues | Costs | | Profit |
|----------------|-------------|---------------------------------|-----------------------------------|--------------------------|
| | | Tradable Inputs | Domestic Factors | |
| Private Prices | $A = P_i^p$ | $B = \sum_{j=1}^k a_{ij} P_j^p$ | $C = \sum_{j=k+1}^n a_{ij} V_j^p$ | $D = A - B - C$ |
| Social Prices | $E = P_i^s$ | $F = \sum_{j=1}^k a_{ij} P_j^s$ | $G = \sum_{j=k+1}^n a_{ij} V_j^s$ | $H = E - F - G$ |
| Divergences | $I = A - E$ | $J = B - F$ | $K = C - G$ | $L = D - H == I - J - K$ |

Source: Monke and Pearson (1989); adapted from von Cramon-Taubadel and Nivyeyskiy (2009, p. 104)

- The subscript i refers to outputs and j refers to inputs
- a_{ij} - for ($j=1$ to k) are technical coefficients for **traded inputs** in the production of i
- a_{ij} - for ($j=k+1$ to n) are technical coefficients for **domestic factors** in production of i
- P_i^p - is the price of output i : *=p private price; *=s social price
- P_j^p - is the price of traded input j ; *=p private price; *=s social price
- V_j^p - is the price of domestic input j ; *=p private price; *=s social price

Private prices for tradable output (P_i^p) and input (P_j^p) are market prices. Social prices for tradable output (P_i^s) and input (P_j^s) are FOB import prices, or CIF export prices. Monke and Pearson (1989) noted that producing a unit of tradable output saves the cost of importing it from abroad, or expands the export thus benefits arise from taking export prices into account. Using tradable input increases the cost of importing it instead of using domestic input; then import price of tradable input reflects social cost. Private prices for domestic factor (V_j^p) are the wage for labour, rent for land, and rate of return for capital.

Appendix Figure 1. Adult livestock loss of *Bulgan* county, *Khovd* province Mongolia (1983-2012)



*Number of loss divided by number of livestock in beginning of the year, by percentage¹⁴.

Note: The years with black frame indicates that the *Dzud* disaster occurred year in Mongolia.

Source: (Statistics Office of *Khovd*, 2004, 2009, 2011, 2013); authors' calculation and figure

Appendix Table 2. Sheep Unit (SHU)

| Livestock | Age group | SHU per livestock |
|-----------|------------------|-------------------|
| Goat | calf (0<age<=1) | 0.288** |
| | young (1<age<=2) | 0.4* |
| | adult (2<age) | 0.9* |
| Sheep | calf (0<age<=1) | 0.49** |
| | young (1<age<=2) | 0.5* |
| | adult (2<age) | 1* |
| Cattle | calf (0<age<=1) | 2.5* |
| | young (1<age<=2) | 4* |
| | adult (2<age) | 5* |
| Horse | calf (0<age<=1) | 2.2*** |
| | young (1<age<=2) | 2.5* |
| | adult (2<age) | 5* |
| Camel | calf (0<age<=1) | 1.82**** |
| | young (1<age<=2) | 3.5**** |
| | adult (2<age) | 7* |

* FAO (2006, p. 14), note that SHU for young cattle is average of two ages, that are 6-18 month old cattle and 18- 24 month old cattle

** Conversion of sheep unit is given for adult female with its nursing kid FAO (2006, p. 24). To take out sheep unit for nursing kid, proportion of kid weight against female adult weight is used.

*** Live weight of foal is about 10% of a mare's live weight (Ministry of Food and Agriculture MOFA, 2010), this is used for estimation.

**** Tsogttuya et al. (2009) reported average life weights of camels by age of 6.5 months (calf), 18 months (young), and adult. We estimated ratio of small/adult, and young/adult then used for conversion coefficient as Adult SHU per camel, given by FAO (2006), is multiplied by ratios.

¹⁴ For example, 95.3 thousand adult livestock died it is divided by 240.7 thousand livestock in the beginning of 2010 (livestock number in the end of 2009) multiplied by 100% gives 39.6% percent. In other words, adult livestock lost in 2010 equals to about 40% of livestock counted in the beginning of the 2010.

Assumptions used for social price estimations

Sheep meat: Custom Agency of Mongolia (2012) reports total export of sheep plus goat meat, and goat meat export separately. So, we estimated that sheep meat export equals to total of sheep and goat meat export minus goat meat export. Camel meat: Camel meat is neither exported nor imported in Mongolia. We assumed the price of camel meat equals to the price of goat meat, because the market prices of goat and camel meat are closest. Cattle hide: there was no export of cattle hide in 2011, but in 2010, so we assumed the price of cattle hide dropped at the same rate as horse hide. Cattle hide in 2010 was 10 USD; we estimated it to be 9.7 USD in 2011; it dropped by 6.7% equal to that of the horse hide price drop rate (2012 cattle hide data was available). Camel wool: we did not distinguish camel wool by its gender. However, camel wool export was listed by gender; therefore, we estimated a weighted average (the weight is exported volume) over the two types of camel wool. Horsehair & tail: we did not distinguish horsehair for two types as hair & tail in the survey questionnaire; we estimated a weighted average over the two. Milk: the only data available for milk is import data for cow milk. Hence, we assumed that the price of other livestock milk is the same as price of cow milk.

Ministry of Road and Transportation (2013) approves that the reference transportation cost per ton per km is 477.72 MNT. The distance from *Bulgan* county centre to *Yarant* border station to China is 46.3 km. Then, cost of transporting 1 kg (say unit transportation cost) loads between border and *Bulgan* is 22 MNT ($(477.72 \times 46.3) / 1000$). Unit transportation cost is subtracted from unit export prices for all exportable goods (5 types of meat, hide and 4 types of hair). But, unit transportation cost is added up to import price for all importable goods (5 types of milk). The assumption is that, if the herder in *Bulgan* wants to export the output, then he/she will have to pay for transportation cost. This cost is included in export price. Hence, to estimate the farm gate social price, the transportation cost should be subtracted from export price. Contrary, if the consumer in *Bulgan* wants to import the milk, then he/she must spend cost for transportation. This cost is not included in import price, hence to estimate the cost to bring the milk from border to consumer in *Bulgan*, the transportation cost should be added on import price.

Appendix Table 3. Annual private income per household, 176 HH (€)

| Type | Outputs | 2011 | | 2012 | | Change in mean (%) |
|--------|---------|-----------------|----------------|-----------------|------------------|--------------------|
| | | Mean±STD | (Min-Max) | Mean±STD | (Min-Max) | |
| Goat | Meat | 586.7±350.9 | (0-2,699.4) | 841.7±466.8 | (0-3,665.2) | 43.5% |
| | Hide | 28.1±16.6 | (0-120.8) | 53.6±37.8 | (0-298.1) | 90.7% |
| | Milk | 202.3±268.5 | (0-1,443.8) | 138.3±245.3 | (0-1,340.1) | -31.6% |
| | Hair | 754.6±670.6 | (0-5,352.1) | 627.8±558 | (0-3,259.5) | -16.8% |
| Sheep | Meat | 259.5±754.3 | (0-9,496.4) | 274.4±463.1 | (0-3,614.7) | 5.7% |
| | Hide | 14.1±38.3 | (0-474.1) | 10.3±17.7 | (0-124.9) | -27.0% |
| | Milk | 8±38.3 | (0-345.5) | 5.8±21.9 | (0-154.3) | -27.5% |
| | Hair | 3.9±14.5 | (0-170.4) | 3.9±15.2 | (0-187.4) | 0.0% |
| Cattle | Meat | 374.6±383.8 | (0-1,838.1) | 460.4±400 | (0-2,203.7) | 22.9% |
| | Hide | 7.8±8.1 | (0-38.3) | 8.1±7.8 | (0-56.8) | 3.8% |
| | Milk | 926.7±1,064.2 | (0-6,585.5) | 1,075.3±1,318.5 | (0-9,197.6) | 16.0% |
| Horse | Meat | 73.9±178.2 | (0-1,080.1) | 94.6±191.2 | (0-482.4) | 28.0% |
| | Hide | 2.4±5.9 | (0-35.6) | 2.2±4.6 | (0-14.2) | -8.3% |
| | Milk | 12±59 | (0-471.2) | 3.3±27.5 | (0-308.1) | -72.5% |
| | Hair | 3.3±16.5 | (0-212.9) | 2.4±5.5 | (0-45.3) | -27.3% |
| Camel | Meat | 34±139.1 | (0-599.2) | 13.2±100.7 | (0-775.5) | -61.2% |
| | Hide | 0.2±0.7 | (0-2.8) | 0±0.4 | (0-2.8) | -100.0% |
| | Milk | 2.3±24.8 | (0-318.4) | 2.9±23.1 | (0-241) | 26.1% |
| | Hair | 18.4±49 | (0-425.9) | 18±63.1 | (0-766.6) | -2.2% |
| Total | | 3,312.8±2,492.6 | (498-24,913.9) | 3,636.3±2,367.1 | (479.7-12,025.7) | 9.8% |

Source: Authors' estimation

Appendix Table 4. Allocation of inputs to outputs

| № | Inputs | | | | Outputs | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----|---------------------------------|---------|-----------|------------------------------------|-----------------------|------------------------------------|-----------------------------|--------------|-------------------------|--|----|-----|-----|-----|------|----|-----|-----|-----|------|----|-----|-----|--|--|--|--|--|--|--|--|--|--|
| | | | | | Meat | | | | | Hide | | | | | Milk | | | | | Hair | | | | | | | | | | | | | |
| | Category | Types | | | go | sh | cat | hor | cam | go | sh | cat | hor | cam | go | sh | cat | hor | cam | go | sh | hor | cam | | | | | | | | | | |
| 1 | Non-tradable Fixed Input | Capital | All type* | Purchased livestock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | Vehicle | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | Housing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | Home appliances | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | Type specific** | Hair scissor/comb | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Non-tradable Intermediate Input | Capital | All type* | Purchased fodder | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | Purchased hay | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | Maintenance for vehicle | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | Health and social insurances | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | Taxes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | Hiring machineries for hay harvest | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | Livestock medicines | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | Type specific** | Livestock insurance | Livestock insurance | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | Loss due to disease | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | Loss due to other reasons | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | Cost of herder hiring | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | Type specific** | Livestock vaccination | Livestock vaccination | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | For large livestock | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | For small livestock | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | Medicines for 4 types of livestock | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | Labour | Land | All type* | Moving | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | Hay harvesting | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | Taking care newborn calves | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | Cleaning shelters | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | Repairing seasonal shelters | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | Type specific** | Slaughtering | Slaughtering | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | Milking | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | Combing and cutting | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | Herding small livestock | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | Herding large livestock | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | Tradable Intermediate Input | Capital | All type* | Land | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | | | | | | | | | | Vehicle fuel for moving between seasonal camps | | | | | | | | | | | | | | | | | | | | | | | |

Source: Authors’ own table
 Note: go-Goat, sh-Sheep, cat-Cattle, hor-Horse, cam-Camel
 *The input is allocated to all 19 types of outputs; **The input is allocated to specific output(s)

The table above shows the input allocation to outputs. Two different income shares are used to allocate costs (Assumption 1):

- The inputs that are used to produce ‘all type’ of outputs irrelevant to type of livestock or output. For this type of inputs allocation is based on income shares of all output.
- The inputs that are used to produce some outputs naming as ‘type specific’. For this type of inputs, income share of that specific livestock or output is used for allocation.

Appendix 2. Cost of fixed input estimation of Essay 1

The fixed inputs are defined as inputs used more than one year in the production. It is used for more than one year; therefore annual cost estimation is needed.

Monke and Pearson (1989, p. 104) suggested a method to estimate annual cost of fixed inputs. The fixed input is purchased with total initial cost Z , and is depreciated by the capital recovery factor (crf), bracketed term of equation 1, which results to obtain A that is 'annual payment sufficient to repay' the initial cost.

$$A = Z \left[\frac{(1+i)^n i}{(1+i)^n - 1} \right] \quad (1) \text{ adapted from Monke and Pearson (1989, p. 104)}$$

Depreciation factors are interest rate (i) and useful life (n) of the item. In our analysis salvage value (S) is deducted from the total initial cost:

$$A = (Z - S) \left[\frac{(1+i)^n i}{(1+i)^n - 1} \right] \quad (2)$$

Equation 2 is used for estimating the annual cost of fixed inputs.

For fixed inputs, interest rate is a price of capital, for the PAM analysis, we used two types of interest rates as a rate of return of capital. Private interest rate is annual interest rate of Mongolia which is 16.6% in 2011, and 18.1% in 2012 (World Bank, 2015c). The social interest rate is an interest rate of a country, which is ranked according to the interest rate of a closely related country based on GDP per capita in 2011. The potential country is Georgia, because GDP per capita of Mongolia (3,772.9 USD) and Georgia (3,219.6 USD) was very close in 2011. Then, we assume that social price of fixed inputs is 15% in 2011, and 14.8% in 2012, which are interest rates of Georgia (World Bank, 2015c).

We consider five types of capital as fixed inputs: purchased livestock, vehicles, housing, home appliances, and wool (cashmere) scissor (comb).

Appendix Table 5. Useful lives and salvage values

| No | Inputs | | Useful life | Salvage value |
|----|---------------------|-------------------|-----------------------------|---------------|
| | Category | Types | | |
| 1 | Purchased livestock | | <i>Separate table below</i> | 0 |
| 2 | Vehicle | Tractor | 10 | 10% |
| | | Truck | 10 | 10% |
| | | Car | 10 | 10% |
| | | Motorcycle | 10 | 10% |
| 3 | Housing | <i>Ger</i> | 36* | 5% |
| | | House | 36 | 5% |
| | | Well | 20 | 5% |
| 4 | Home appliances | Solar panel | 8 | 0 |
| | | TV | 7 | 0 |
| | | Radio | 7 | 0 |
| | | TV Receiver | 7 | 0 |
| | | Freezer | 10* | 0 |
| | | Fridge | 20* | 0 |
| | | Scythe | 20* | 0 |
| | | Stove and chimney | 6* | 0 |
| | | Chair | 5* | 0 |
| | | Table | 15* | 0 |
| 5 | Wool scissor/comb | | 10* | 0 |

Source: Government of Mongolia (2005b)

Note: *Assumed

If the fixed input (e.g., house) has been used more years than useful life then we take this used years as a useful life of that item of that household. Useful life and salvage value of purchased livestock is discussed in below section.

Resolution of Government of Mongolia (2005b) enacted the reference useful lives and salvage values of assets. However, some items are not included in the resolution, hence they are assumed.

Purchased livestock

The livestock is the most important asset for HH, which is live and susceptible to natural conditions, making the herders' livelihood vulnerable to natural disasters, like *Dzud* 2009-2010. In the analysis, we did not consider all livestock as fixed input, but only purchased ones because the majority of the livestock is raised by family labour, not purchased from the market. The labour cost is accounted in this study; hence, we only consider purchased livestock in 2011 and 2012 as investment fixed input.

Herders purchase livestock for restocking purposes. Restocking needs to be done when livestock number decreases due to *Dzud*. Many households started to purchase livestock after 2010 *Dzud*, evident from the survey. To estimate the cost of livestock purchase as an investment cost for future production, we assume that cost of livestock purchase occur in every ten years, as it is the frequency of *Dzud* occurrence in *Bulgan*¹⁵. First, we estimated average percentage of livestock to be purchased in SHU in the sample, and then this percentage is divided by 10 years and multiplied by one SHU livestock price. In other words, this number represents a monetary value of livestock purchase per SHU per HH. Then, number of livestock in SHU is multiplied by this coefficient.

¹⁵ Frequency of *Dzud* is about six years according to Reading et al. (2006, p. 8). But, it is not the case for *Bulgan*. As Oyunmunkh, PhD student of WATERCOPE project, surveyed 100 households in 2013 about *Dzud* occurred years in *Bulgan* river basin. The survey results that the *Dzud* frequency is about every 10 years in *Bulgan* river basin (personal interview).

Vehicles

The most important vehicles in *Bulgan* county are Chinese motorcycles and second hand Russian trucks. Almost half of the households (46.6%) have motorcycles, but few have trucks (10.8%)¹⁶. Herders ride motorcycles to travel between seasonal pastures, hay harvest plots, travelling to central areas, towns, and used for transporting purposes too, e.g. cashmere. Trucks are used by herders for nomadic transportation between seasonal camps. Households that do not have their own truck hire a truck from other households by paying a vehicle fuel cost for the truck. Very few HH own a car (10.2%) or a tractor (1.1%).

Housing

Three types of assets are considered as housing type fixed inputs in our analysis, including *Ger*, house and well. 1) *Ger* is the portable tent (yurt in Turkish) covered by felt. The *Ger* is both production site and residence for HH. Herders may have a number of different types of *Gers* for seasonal use: smaller and thin felt layered ones for summer and autumn camp easy to carry, big and thick felt layered ones for winter and spring camp etc. For simplicity, we did not distinguish size and layer of the yurt in our analysis. 2) Some households have houses mostly built near county centre, especially for Kazakh households. Kazakh (some *Torguud*) people use natural mud, found in downside of the *Bulgan* county, to make mud bricks (area of *Bayansudal and Tsookhor Salty Lake*). After drying the bricks, they build their own houses, because wood for buildings is very scarce and expensive. 3) About half (45.5%) of the households have their own well in their spring or autumn camp in 2011. In most cases the well is dug and constructed by the household itself.

Most of the households have livestock fences and shelters, which are used for many purposes in livestock husbandry. Although, very few households answered the question of cost related to fences and shelters because herders inherit them over generations and do not know how much cost is spent to build or buy the shelter. Hence, we excluded cost of fences and shelters from the analysis.

Home appliances

Because nomadic livestock production is a family business, often there is no distinguished tools used for producing products, hence most of the home appliances are interchangeably used both for consumption and production (Appendix Table 5).

Most of the HH have a solar panel and television (including TV receiver with monthly premium). Television does not add directly to the input of production but is important tool to get information about weather, climate, market situation, and prices, politics for HH who move between far pastures. Without a solar panel and its battery electric items, like lights, TV, fridge etc., are not possible.

Wool scissor/comb

Scissors are used to cut wool of sheep and camel, hair & tail of horse, and a comb is used to comb cashmere from goat. These items are only used for hair products, hence considered as product specific.

¹⁶ Percentages in bracket are proportion of households, who has the vehicle, in total number of sample of 176 HH in 2011

Cost of non-tradable intermediate inputs

Because the input is not exported from or imported to Mongolia, we used an approach called ‘standard conversion factor (SCF)’ developed by Squire and van der Tak (1975, p. 73)¹⁷ with following equation:

$$SCF = \frac{M + X}{(M + T_m) + (X - T_x)} \quad (3) \text{ adapted from European Union (2008, p. 51)}$$

Standard conversion factor is a ratio of internationally traded goods in border prices (nominator) to its domestic prices (denominator). Domestic price of imported goods paid by consumers equals total import (M) plus import tax (T_m), on the other hand for exported goods it equals total export (X) minus import tax (T_x).

Equation 3 is extended by including subsidy of import (S_m) and export (S_x) in the denominator by European Union (2015, p. 308):

$$SCF = \frac{M + X}{(M + T_m - S_m) + (X - T_x + S_x)} \quad (4) \text{ adapted from European Union (2015, p. 308)}$$

In the case of Mongolia, SCF is equal to 0.916 in 2011, based on data from National Statistics office, Annual budget and financial report, and the Central bank of Mongolia.

Appendix Table 6. Estimation of Standard Conversion Factor in Mongolia (Million MNT)

| Indicators | 2011 | 2012 |
|----------------------|--------------|--------------|
| Import tax (Mt)* | 1,348,386.4 | 1,375,990.7 |
| Export tax (Xt)* | 185.5 | 195.2 |
| Import subsidy (Ms)* | 23950.8 | 39446.7 |
| Export subsidy (Xs) | 0 | 0 |
| Import (M)** | 8,350,356.5 | 9,159,782.4 |
| Export (X)** | 6,096,642.6 | 5,959,723.7 |
| SCF (Eq. 4) | 0.916 | 0.919 |

Source: * Government of Mongolia (2014a, p. 13, 113), SCF estimation is done by the Authors of this paper.

** National Statistical Office of Mongolia (NSOM, 2015b). Export and import was reported in USD in NSOM (2015b), hence we converted them into MNT using average annual exchange rate 1USD=1265 MNT, reported by Central Bank of Mongolia (2015).

The SCF in 2011 (2012) was 0.916 (0.919), meaning that if (SCF is less than 1) an input has a lower international price than domestic. Domestic non-tradable inputs have lower prices if they are traded on the international market, having a disadvantage; hence, it is better to be used domestically. However, Mongolian SCF is not so far from 1, meaning that there is only a slight difference between private and social prices of non-tradable inputs.

¹⁷Actually the name is not ‘standard conversion factor’, but ‘consumption conversion factor’ written by Squire and van der Tak (1975, p. 73). However, the formula of consumption conversion factor is used in literature and guides as ‘standard conversion factor’ for example in “Guide to cost-benefit analysis of investment projects” by European Union (2008, p. 51).

CAPITAL

- All type

Purchased fodder: Herders sometimes feed the livestock with fodder (wheat, salt, oats, allmash (mixed fodder), bran, granules, rye) during winter and spring when livestock is weak and losing weight or is sick. Some households cultivate fodder crops by themselves, but these fodder crops are not considered in our analysis.

Purchased hay: Very few households buy hay for winter preparation because most of the households harvest the hay themselves. Households who buy hay have to do so due to an inadequate work force for hay harvest. We did not take harvested hay as an intermediate capital in our analysis because it is made by manpower and treated as intermediate labour cost.

Vehicle Maintenance: The most costly maintenance cost is attached to motorcycles for herders, as this is used daily, more than usage of trucks.

Insurances: We considered 3 types of insurances including health, social, and livestock insurances (type specific). In Mongolia, there is an ongoing project called “Index-based livestock insurance in Mongolia” since 2006 to insure livestock against risk of *Dzud* disaster. In our sample, only 4 (2) households out of 176 insured some of their sheep and goat in 2011 and 2012. 11.4% of the households paid social insurance, while 90.9% paid health insurance in 2011. We assumed that the health and social insurance cost is the same for both years.

Taxes: Herder households pay taxes for firewood, land possession tax, assets including vehicle, television, and gun¹⁸.

Hiring machinery for hay harvest: There is a need to hire machinery (trucks and tractors) for harvesting and transporting the hay for households who are lacking manpower and machinery. 47.7% (71.6%) of the households hire machinery for hay harvest in 2011 (2012).

Livestock medicines: To prevent livestock diseases, sometimes herders buy livestock medicines to cure urgent illnesses. Four types of livestock medicines are categorized in basic two types: medicine for all livestock, and medicine for specific livestock.

- Type specific

Livestock loss: Livestock die due to two reasons in non-*Dzud* years, which are disease and other reasons. Other reasons of livestock death include eaten by wolves, stolen, missing or lost etc. 41 (49) households, out of 176, have incurred livestock loss due to disease, but 74 (60) due to other reasons in 2011 (2012).

Cost of herder hiring: Households with few livestock, who lost most of their livestock in *Dzud* in 2010, give their livestock to another HH (relatives, friends, neighbours) for a certain time, especially summer either for an agreed upon monetary fee or for free. This is related to high cost of moving to seasonal camps. In our sample, 52.8% (50.6%) of survey households have spent this type of cost in 2011 (2012),

¹⁸ Gun is used for hunting wolves that are the most dangerous predator for livestock in Mongolia.

because of *Dzud* in 2010 many households lost their livestock and then since 2011 many households decided not to move to seasonal pastures themselves, but append their livestock to others who are moving.

Livestock vaccination: The government pays for per unit cost, transportation, and partial service fee of vaccines for livestock diseases (*foot-and-mouth, brutsellyoz, anthrax, rabies, enterotoxemia* etc.) in Mongolia. The vaccines are type specific intermediate input.

Labour cost estimation

There is no information on salary of herders because nomadic livestock production is based on family labour and a herder is rarely hired or employed by a producer.

Hence opportunity cost of herding labour is low in the countryside as there are no alternative jobs to be found, unless one moves to cities. Because limited data, we assume that private salary of herder equals to national poverty line. The assumption can be made that herders are to be paid at survival rate (poverty line) if employed by other jobs in *Bulgan* county.

The poverty line in 2011 was 99,729 MNT (€56.3) per person per month (ppm) define by NSOM (2015d) in Mongolia, which is about 3,324.3 MNT (€1.9) per person per day (ppd). Private labour cost is converted to social using standard conversion factor, results that 3,045.1 MNT (€1.73) ppd. In 2012 the poverty line increased to 118,490 MNT (€67.3) ppm, which equals 3,949.7 MNT (€2.24) ppd.

There is no private cost for land for herders, as they do not pay for using natural pastureland, in other words private cost of land is zero. However, indispensable natural pastureland is degraded if the livestock number exceeds the carrying capacity of the land. Then the externality of livestock production exist prohibiting growth of natural biodiversity even to human society.

LABOUR:

- **All types**

Moving: Moving between pastures is the crucial factor for defining '*nomadism*'. In *Bulgan*, moving livestock does not mean they transport the livestock on trucks, but moving them on foot for long distances. Basically labour for moving is divided into two category moving between and within seasonal camps¹⁹. Labour for moving is, first, time spent for packing (unpacking) and transportation, second,

¹⁹ Seasonal camps are described below:

- *Spring camp*. Spring camp where the livestock give a birth thus, it requires warm shelter with hay. Traditionally, herders move from winter camp to spring camp to receive new calves and to comb cashmere. Spring camps in *Bulgan* county is the closest camp to county center.
- *Summer camp*. Herders of *Bulgan* county move from spring camp to summer camp to fatten the livestock with more grass in high mountains and remote pastureland. The most importantly livestock can gain more weight for meat and give more milk. Moving from spring camp to summer camp in *Bulgan* is the longest trip. Herders prepare most of dairy products during summer time by milk, and consume them until next summer.

moving a whole herd of livestock. Herders move/drive the herd approximately for three days to reach the spring to summer camp. For transporting their *Ger* and other items, they use camels and old Russian trucks in *Bulgan* county, separately from their livestock. Moving within seasonal camp means that herder household change their living spot from one to another spot within the seasonal pasture, more within movements happen during summer time depending on the grass availability.

Hay harvesting: The area of *Bulgan* county is semi-desert and dry land where biomass and precipitation are not enough to rely on natural grass for livestock to survive winter. Mostly, the head of household organize hay harvest operation with their children and relatives, neighbours, and hired help. It starts in the beginning of August, before they move down from summer pasture to autumn pasture, and continues for about one month. One or two family member stay in home for taking care of the livestock then the remaining work force leaves for hay harvest. Hay plots are located near to the autumn pasture, as it is easy to transport harvested hay to autumn camp by trucks, camels, or horses. Herders do not fertilize the hay plots, and seldom irrigate by water canals from *Bulgan* river. Our analysis includes labour spent for hay harvest and irrigating the hay plots.

Taking care of new-born livestock in spring: Herders work hard in spring time to take care of new-born young to avoid any loss or miscarriage. New-born goats and lambs need more assistance than other new-born young. Daily work for this labour includes searching for new-borns in the field during grazing, and taking them to the home, giving hay, and taking the weaker new-borns into *Ger* or warm shelter.

Cleaning shelters: Cleaning livestock shelter is the first job in the morning for herders. In the morning after the livestock went for grazing herders start cleaning the shelter to remove dung. Removed dung is transported to special place where they collect dung. Herders use cattle and horse dung to burn in stove for cooking purpose, and warming the *Ger*, and it is used for insulating the walls and roofs of the livestock shelters preparing for winter. Most of this type of labour is spent in spring and winter times as the livestock stays more time in the shelter than summer and autumn.

Repairing seasonal shelters: Before a move to the next seasonal camp, herders repair broken shelters and renew them if necessary. It takes some days for repairing the winter camps. In *Bulgan* county, there is very little forest area most of which are located within protected areas in higher mountains. Thus, herders use stones to build fences or shelters in *Bulgan* county.

- **Type specific**

Slaughtering, milking and combing or cutting labour are type specific labour to prepare meat, milk, and hair products. For example labour milking cow is allocated to only to cow milk, but not any other outputs. Herders slaughter livestock manually without machinery. One herder can slaughter a goat and sheep, but at least two people are needed to slaughter a cattle, horse, or camel. Milking time is different by types of livestock. Herders prepare most of the milk in summer time and make dairy products. Most of the *Kazakh*

-
- *Autumn camp.* Fattened livestock graze less time than summer in autumn pastureland. Livestock market is more active during the time when herders sell and buy livestock and the meat reaches lowest price.
 - *Winter camp.* Herders have least workload during winter. They move to winter camp where the snow height is lower and protected from wind. Warm shelter and enough hay are more crucial for goat and sheep.

households milk their goats, but not many Mongolians. Few households milk sheep, horse, and camel in *Bulgan* county.

Sheep shearing and goat cashmere combing labour is also important. Sheep shearing is not only to produce hair product but also to gain more weight for sheep. Hence, sheep shearing labour is allocated to all (4) products of the sheep, which is not the case for goat, horse and camel.

Daily livestock herding: In the morning, herders drive the herd (mostly sheep and goat as they are as are more vulnerable to coming dangers) from home shelter to the pastureland. Livestock are also herded to waterbodies for watering and driven across the pastureland and back home in the evening. Additionally, herders watch the livestock in order to avoid mixing their own herd with the neighbours' herds or coming danger e.g. wolves or thieves. Usually a household head is in charge for daily herding labour, except during summer time. Conversely, school children herd their livestock daily during summer, while male adults have rest and put more labour into looking for their horses and camels in far pastures, going for hay harvest, or preparing for winter. In our sample, a herder spends about 8.8 hours for daily herding on average, which is about 48 minutes more than official daily working hours in Mongolia.

Horses and camels do not require daily herding labour because they stay in far pastures in mountains or steppes by themselves. For cattle, herders do not herd cattle to the pastureland. Cattle go to the pasture after morning milking and come back to home themselves for evening milking.

We assumed that a herder above 60 years old and children (only in summer pasture) who herd livestock daily, are equal to 0.5 unit of manpower.

Land cost estimation

Government of Mongolia submitted a proposal of law on asset tax to Parliament of Mongolia for discussion (Government of Mongolia, 2014b). In this proposal the livestock tax is proposed with following stipulations:

- 1) tax is paid per tax sheep unit (TSU), different than physiological sheep unit (SHU), of livestock: 1 goat equal to 2 TSU, sheep 1 TSU, horse and cattle 5 TSU, and camel 2 TSU;
- 2) tax amount can be 0-1000 MNT per TSU depending on decision of province representatives' council²⁰.

We assume that the cost of pastureland is equal to 500 MNT, an average, per TSU proposed by Government of Mongolia (2014b).

Estimation of tradable input cost

The only one input considered as a tradable input in our analysis is vehicle fuel used for moving between seasonal camps. Although livestock medicines and vaccines are imported goods, there is no source to

²⁰ Between 2006 and 2009, during the time when livestock tax was effective 1 goat=1.5 TSU, but by this proposal, it is even increased to 2TSU, also another difference is that before tax rate was 50 MNT per TSU, but now it is 0-1000 MNT (Parliament of Mongolia (2006).

obtain import price data of them. Hence, we assumed them to be non-tradable inputs. However, as long as we did not compute DRC or PCR, there is no difference of classifying the inputs into tradable or non-tradable categories.

To estimate vehicle fuel volume used for moving distance between seasonal camps, we assume that a truck utilizes 37 litre of vehicle fuel per 100 km reported by Bakey et al. (2010). Furthermore, we assume that one truck loads two families stuff and split the cost. Consequently, 41.5% (44.3%) of households out of 176 HH have spent cost for vehicle fuel in 2011.

The private price per litre of vehicle fuel is 1,442 MNT (1,691 MNT) as of annual price in *Khovd* province in 2011 (2012) (NSOM, 2015a). We estimated the social price as 1,281 MNT (1,512 MNT) per litre as import price according to Custom Agency of Mongolia (2012)²¹ in 2011(2012).

Appendix Table 7. Average private cost per unit of output (MNT per unit)

| Type | Outputs | 2011 | | | | | 2012 | | | | | | |
|--------|-----------------|---------------------|---------|--------|------|--------------------|---------------|---------------------|---------|--------|------|--------------------|---------------|
| | | Domestic Factor (C) | | | | Tradable input (B) | Total (C+B) | Domestic Factor (C) | | | | Tradable input (B) | Total (C+B) |
| | | Fixed input | Capital | Labour | Land | | | Fixed input | Capital | Labour | Land | | |
| Goat | Meat (MNT/kg) | 383 | 628 | 1,717 | 0 | 144 | 2,872 | 593 | 960 | 2,387 | 0 | 197 | 4,137 |
| | Hide (MNT/unit) | 377 | 618 | 1,782 | 0 | 141 | 2,918 | 783 | 1,291 | 3,248 | 0 | 269 | 5,590 |
| | Milk (MNT/L) | 85 | 142 | 542 | 0 | 37 | 806 | 113 | 169 | 629 | 0 | 39 | 951 |
| | Hair (MNT/kg) | 6,245 | 9,952 | 27,741 | 0 | 2,228 | 46,166 | 5,437 | 8,576 | 22,826 | 0 | 1,760 | 38,599 |
| Sheep | Meat (MNT/kg) | 544 | 908 | 1,907 | 0 | 202 | 3,561 | 702 | 1,205 | 2,524 | 0 | 302 | 4,733 |
| | Hide (MNT/unit) | 806 | 1,343 | 2,926 | 0 | 299 | 5,373 | 813 | 1,394 | 2,989 | 0 | 340 | 5,535 |
| | Milk (MNT/L) | 80 | 132 | 471 | 0 | 39 | 722 | 108 | 184 | 680 | 0 | 32 | 1,003 |
| | Hair (MNT/kg) | 132 | 189 | 145 | 0 | 13 | 479 | 75 | 119 | 127 | 0 | 16 | 337 |
| Cattle | Meat (MNT/kg) | 337 | 408 | 627 | 0 | 129 | 1,501 | 622 | 721 | 1,024 | 0 | 214 | 2,581 |
| | Hide (MNT/unit) | 1,242 | 1,502 | 3,216 | 0 | 475 | 6,435 | 1,933 | 2,160 | 4,138 | 0 | 664 | 8,895 |
| | Milk (MNT/L) | 101 | 127 | 264 | 0 | 39 | 530 | 118 | 141 | 315 | 0 | 41 | 615 |
| Horse | Meat (MNT/kg) | 498 | 672 | 693 | 0 | 127 | 1,991 | 709 | 1,019 | 1,029 | 0 | 180 | 2,937 |
| | Hide (MNT/unit) | 2,594 | 3,504 | 4,509 | 0 | 660 | 11,266 | 2,719 | 3,827 | 4,973 | 0 | 676 | 12,195 |
| | Milk (MNT/L) | 211 | 231 | 306 | 0 | 67 | 815 | 175 | 241 | 362 | 0 | 18 | 795 |
| | Hair (MNT/kg) | 3,920 | 5,011 | 1,308 | 0 | 89 | 10,329 | 2,220 | 4,799 | 1,147 | 0 | 127 | 8,292 |
| Camel | Meat (MNT/kg) | 297 | 592 | 658 | 0 | 60 | 1,606 | 163 | 473 | 1,036 | 0 | 72 | 1,744 |
| | Hide (MNT/unit) | 397 | 793 | 1,796 | 0 | 80 | 3,067 | 169 | 489 | 2,143 | 0 | 74 | 2,875 |
| | Milk (MNT/L) | 159 | 160 | 315 | 0 | 93 | 727 | 175 | 119 | 241 | 0 | 77 | 611 |
| | Hair (MNT/kg) | 870 | 1,097 | 884 | 0 | 193 | 3,043 | 712 | 1,417 | 917 | 0 | 267 | 3,313 |

Source: Authors' estimation

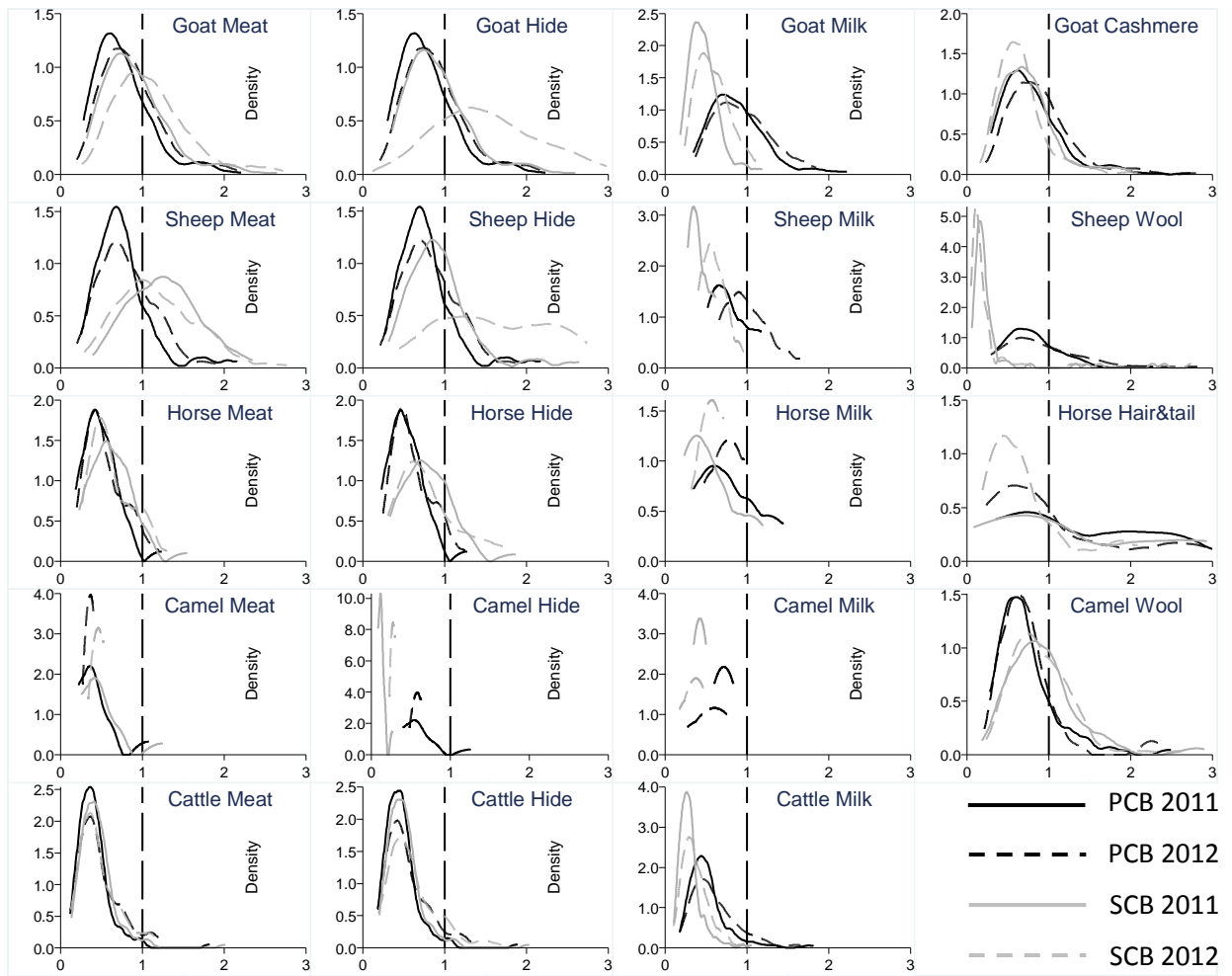
²¹ The USD amount of vehicle fuel is divided by quantity amount, imported from Russia to Mongolia, then converted to MNT.

Appendix Table 8. Average social cost per unit of output (MNT per unit)

| | | 2011 | | | | | 2012 | | | | | | |
|--------|-----------------|---------------------|---------|--------|-------|--------------------|---------------|---------------------|---------|--------|-------|--------------------|---------------|
| Type | Outputs | Domestic Factor (G) | | | | Tradable input (F) | Total (G+F) | Domestic Factor (G) | | | | Tradable input (F) | Total (G+F) |
| | | Fixed input | Capital | Labour | Land | | | Fixed input | Capital | Labour | Land | | |
| Goat | Meat (MNT/kg) | 356 | 576 | 1,573 | 95 | 128 | 2,744 | 515 | 882 | 2,194 | 129 | 176 | 3,896 |
| | Hide (MNT/unit) | 351 | 566 | 1,632 | 93 | 125 | 2,783 | 680 | 1,186 | 2,985 | 179 | 241 | 5,271 |
| | Milk (MNT/L) | 80 | 130 | 496 | 22 | 32 | 765 | 98 | 156 | 578 | 25 | 35 | 893 |
| | Hair (MNT/kg) | 5,809 | 9,116 | 25,410 | 1,504 | 1,980 | 44,067 | 4,727 | 7,882 | 20,977 | 1,177 | 1,573 | 36,337 |
| Sheep | Meat (MNT/kg) | 505 | 831 | 1,747 | 103 | 179 | 3,388 | 613 | 1,107 | 2,320 | 132 | 270 | 4,442 |
| | Hide (MNT/unit) | 748 | 1,230 | 2,680 | 152 | 265 | 5,109 | 709 | 1,281 | 2,747 | 158 | 304 | 5,199 |
| | Milk (MNT/L) | 74 | 121 | 431 | 12 | 35 | 678 | 94 | 169 | 625 | 16 | 28 | 932 |
| | Hair (MNT/kg) | 122 | 173 | 132 | 55 | 12 | 496 | 67 | 110 | 116 | 37 | 14 | 344 |
| Cattle | Meat (MNT/kg) | 314 | 373 | 574 | 37 | 115 | 1,428 | 541 | 662 | 941 | 61 | 191 | 2,397 |
| | Hide (MNT/unit) | 1,157 | 1,376 | 2,946 | 135 | 422 | 6,089 | 1,679 | 1,985 | 3,803 | 189 | 594 | 8,250 |
| | Milk (MNT/L) | 93 | 116 | 242 | 11 | 34 | 502 | 102 | 129 | 289 | 12 | 37 | 570 |
| Horse | Meat (MNT/kg) | 463 | 616 | 635 | 61 | 113 | 1,902 | 620 | 936 | 945 | 153 | 161 | 2,816 |
| | Hide (MNT/unit) | 2,413 | 3,209 | 4,130 | 317 | 586 | 10,729 | 2,377 | 3,517 | 4,570 | 530 | 604 | 11,599 |
| | Milk (MNT/L) | 194 | 212 | 280 | 150 | 60 | 903 | 156 | 221 | 332 | 134 | 16 | 860 |
| | Hair (MNT/kg) | 3,597 | 4,590 | 1,198 | 4,018 | 79 | 13,494 | 2,028 | 4,410 | 1,054 | 3,578 | 113 | 11,183 |
| Camel | Meat (MNT/kg) | 276 | 542 | 603 | 5 | 53 | 1,485 | 142 | 434 | 952 | 5 | 64 | 1,597 |
| | Hide (MNT/unit) | 370 | 727 | 1,645 | 7 | 71 | 2,828 | 147 | 450 | 1,969 | 5 | 67 | 2,637 |
| | Milk (MNT/L) | 148 | 147 | 288 | 19 | 82 | 694 | 153 | 109 | 221 | 14 | 69 | 566 |
| | Hair (MNT/kg) | 805 | 1,005 | 810 | 243 | 171 | 3,055 | 626 | 1,302 | 843 | 310 | 239 | 3,320 |

Source: Authors' estimation

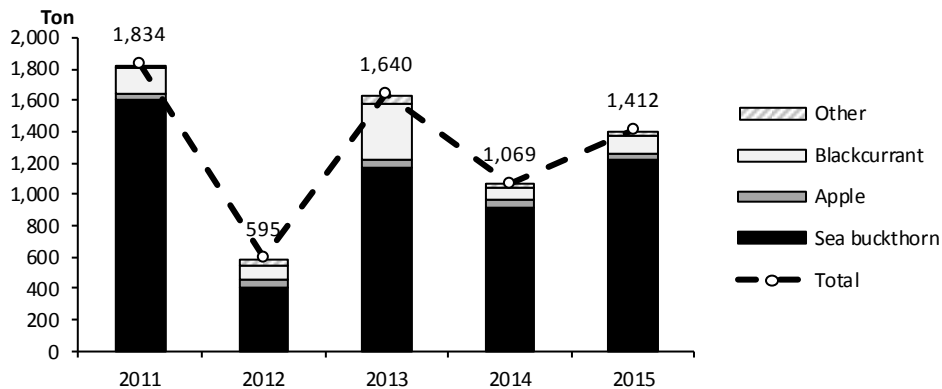
Appendix Figure 2. Kernel Density of PCB and SCB ratios in 2011 and 2012, by each output type



Source: Authors' estimation

Note: Incomes and costs of each output of that type of livestock are summed up. PCB and SCB ratios over 3.0 are not depicted on the graphs. PCB (SCB) ratio between 0 and 1 represents that given livestock production is privately (socially) competitive.

Appendix Figure 3. Fruit production in Mongolia, by types (Ton)



Source: NSOM (2016a)

Appendix Table 9. Total harvested volume of sea buckthorn berry in Mongolia, by region (Ton)

| Regions | Provinces | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------------------|------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Western | Bayan-Ulgii | 5 (0.3%) | 2.6 (0.6%) | 3.3 (0.3%) | 9.6 (1%) | 20.9 (1.7%) |
| | Gobi-Altai | 21.1 (1.3%) | 53.7 (12.9%) | 39.7 (3.4%) | 9.6 (1%) | 24.5 (2%) |
| | Zavkhan | 0 (0%) | 0 (0%) | 0 (0%) | 6.4 (0.7%) | 28.8 (2.3%) |
| | Uvs | 1199.4 (74.5%) | 101.3 (24.4%) | 524.8 (44.5%) | 457.5 (49.4%) | 753.1 (61.5%) |
| | Khovd | 56.5 (3.5%) | 60.9 (14.7%) | 64.4 (5.5%) | 46.8 (5%) | 25.1 (2.1%) |
| TOTAL OF WESTERN | | 1282 (79.6%) | 218.5 (52.6%) | 632.2 (53.6%) | 529.9 (57.2%) | 852.3 (69.6%) |
| Khangai | Arkhangai | 0 (0%) | 0 (0%) | 0 (0%) | 1.6 (0.2%) | 3.8 (0.3%) |
| | Bayan-Khongor | 0 (0%) | 0 (0%) | 0 (0%) | 5.5 (0.6%) | 32.2 (2.6%) |
| | Bulgan | 3 (0.2%) | 36.2 (8.7%) | 36.5 (3.1%) | 109.1 (11.8%) | 31.9 (2.6%) |
| | Orkhon | 0 (0%) | 0 (0%) | 0.5 (0%) | 4.6 (0.5%) | 2.5 (0.2%) |
| | Uvurkhangai | 1.6 (0.1%) | 3.3 (0.8%) | 56.2 (4.8%) | 1.9 (0.2%) | 6.5 (0.5%) |
| | Khuvsgul | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| TOTAL OF KHANGAI | | 4.6 (0.3%) | 39.5 (9.5%) | 93.2 (7.9%) | 122.7 (13.2%) | 76.9 (6.3%) |
| Central | Gobisumber | 0.8 (0.1%) | 1.2 (0.3%) | 4 (0.3%) | 0 (0%) | 0 (0%) |
| | Darkhan-Uul | 96.7 (6%) | 15.9 (3.8%) | 47.3 (4%) | 26.2 (2.8%) | 22.2 (1.8%) |
| | Dornogobi | 0 (0%) | 0.5 (0.1%) | 0 (0%) | 0 (0%) | 0.8 (0.1%) |
| | Dundgobi | 0.3 (0%) | 1.3 (0.3%) | 1.9 (0.2%) | 2.1 (0.2%) | 0 (0%) |
| | Umnugobi | 2.7 (0.2%) | 3.3 (0.8%) | 3.2 (0.3%) | 3 (0.3%) | 6.3 (0.5%) |
| | Selenge | 47.5 (2.9%) | 62.8 (15.1%) | 161.2 (13.7%) | 132.6 (14.3%) | 78.9 (6.4%) |
| | Tuv | 122.3 (7.6%) | 46.3 (11.1%) | 136.1 (11.5%) | 22.5 (2.4%) | 75.1 (6.1%) |
| TOTAL OF CENTRAL | | 269.6 (16.7%) | 130.1 (31.3%) | 349.8 (29.7%) | 186.5 (20.1%) | 183.3 (15%) |
| Eastern | Dornod | 0 (0%) | 0.4 (0.1%) | 1.7 (0.1%) | 0.9 (0.1%) | 3.3 (0.3%) |
| | Sukhbaatar | 0.8 (0.1%) | 0.6 (0.1%) | 1.8 (0.2%) | 10.2 (1.1%) | 2.2 (0.2%) |
| | Khentii | 53.8 (3.3%) | 26.1 (6.3%) | 100.1 (8.5%) | 9.3 (1%) | 10.2 (0.8%) |
| TOTAL OF EASTERN | | 0 (0%) | 0.2 (0%) | 0.5 (0%) | 20.4 (2.2%) | 15.7 (1.3%) |
| ULAANBAATAR | | 53.8 (3.3%) | 26.1 (6.3%) | 100.1 (8.5%) | 67.4 (7.3%) | 96.9 (7.9%) |
| TOTAL | | 1610.9 (100%) | 415.4 (100%) | 1179.3 (100%) | 926.9 (100%) | 1225.1 (100%) |

Source: National Statistical Office of Mongolia (NSOM, 2016a)

Note: Percentages in brackets indicate the share of a province or region in total volume in Mongolia, at the bottom of the table.

Appendix Table 10. Total production of sea buckthorn berry in Mongolia, by region (Thousand USD)

| Regions | Provinces | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------------------|------------------|----------------------|----------------------|-----------------------|-----------------------|-----------------------|
| Western | Bayan-Ulgii | 16.1 (0.3%) | 8.8 (0.6%) | 11.9 (0.3%) | 35.3 (1%) | 82 (1.7%) |
| | Gobi-Altai | 67.7 (1.3%) | 184.8 (12.1%) | 142.9 (3.1%) | 35.3 (1%) | 96.1 (2%) |
| | Zavkhan | 0 (0%) | 0 (0%) | 0 (0%) | 23.3 (0.7%) | 113 (2.3%) |
| | Uvs | 3850.1 (72%) | 348.5 (22.9%) | 1889.4 (40.9%) | 1674.3 (49.4%) | 2959.5 (61.5%) |
| | Khovd | 181.4 (3.4%) | 209.5 (13.8%) | 231.8 (5%) | 171.3 (5%) | 98.8 (2.1%) |
| TOTAL OF WESTERN | | 4115.3 (77%) | 751.6 (49.4%) | 2276 (49.3%) | 1939.5 (57.2%) | 3349.4 (69.6%) |
| Khangai | Arkhangai | 0 (0%) | 0 (0%) | 0 (0%) | 5.9 (0.2%) | 15 (0.3%) |
| | Bayan-Khongor | 0 (0%) | 0 (0%) | 0 (0%) | 20.1 (0.6%) | 126.5 (2.6%) |
| | Bulgan | 9.6 (0.2%) | 124.5 (8.2%) | 131.5 (2.8%) | 399.2 (11.8%) | 125.5 (2.6%) |
| | Orkhon | 0 (0%) | 0 (0%) | 1.9 (0%) | 16.8 (0.5%) | 9.8 (0.2%) |
| | Uvurkhangai | 5.1 (0.1%) | 11.5 (0.8%) | 202.2 (4.4%) | 6.8 (0.2%) | 25.6 (0.5%) |
| | Khuvsgul | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| TOTAL OF KHANGAI | | 14.7 (0.3%) | 136 (8.9%) | 335.6 (7.3%) | 448.8 (13.2%) | 302.4 (6.3%) |
| Central | Gobisumber | 2.7 (0.1%) | 4 (0.3%) | 14.5 (0.3%) | 0 (0%) | 0 (0%) |
| | Darkhan-Uul | 310.5 (5.8%) | 54.8 (3.6%) | 170.3 (3.7%) | 96 (2.8%) | 87.1 (1.8%) |
| | Dornogobi | 0 (0%) | 1.7 (0.1%) | 0 (0%) | 0 (0%) | 3.1 (0.1%) |
| | Dundgobi | 1 (0%) | 4.3 (0.3%) | 6.8 (0.1%) | 7.9 (0.2%) | 0.1 (0%) |
| | Umnugobi | 8.8 (0.2%) | 11.4 (0.7%) | 11.5 (0.2%) | 10.9 (0.3%) | 24.9 (0.5%) |
| | Selenge | 152.5 (2.9%) | 216.1 (14.2%) | 580.4 (12.6%) | 485.3 (14.3%) | 309.9 (6.4%) |
| | Tuv | 392.7 (7.3%) | 159.2 (10.5%) | 490.1 (10.6%) | 82.4 (2.4%) | 295.1 (6.1%) |
| TOTAL OF CENTRAL | | 868.2 (16.2%) | 451.5 (29.7%) | 1273.6 (27.6%) | 682.5 (20.1%) | 720.2 (15%) |
| Eastern | Dornod | 0 (0%) | 1.2 (0.1%) | 6.2 (0.1%) | 3.2 (0.1%) | 13 (0.3%) |
| | Sukhbaatar | 2.7 (0%) | 2.1 (0.1%) | 6.5 (0.1%) | 37.3 (1.1%) | 8.8 (0.2%) |
| | Khentii | 172.6 (3.2%) | 89.8 (5.9%) | 360.3 (7.8%) | 34.2 (1%) | 40 (0.8%) |
| TOTAL OF EASTERN | | 175.3 (3.3%) | 93.1 (6.1%) | 373 (8.1%) | 74.7 (2.2%) | 61.8 (1.3%) |
| ULAANBAATAR | | 172.6 (3.2%) | 89.8 (5.9%) | 360.3 (7.8%) | 246.8 (7.3%) | 380.7 (7.9%) |
| TOTAL | | 5346.1 (100%) | 1522 (100%) | 4618.5 (100%) | 3392.3 (100%) | 4814.5 (100%) |

Source: Authors' estimation based on National Statistical Office of Mongolia (NSOM, 2016a)

Note: Percentages in brackets indicate the share of a province or region in total production in Mongolia, at the bottom of the table. The production is estimated that harvested quantity is multiplied by annual average price.

Appendix 3. Cost of fixed input estimation of Essay 2

Appendix Table 11. The inputs of sea buckthorn farming

| No | Inputs | Types | Subtypes | | |
|----|---------------------------------|-----------------------------|-----------------------------------|--------------------------------------|--------------|
| 1 | Non-Tradable Fixed Inputs | Building irrigation canal | | | |
| 2 | | Building fence | | | |
| 3 | | Seedlings | | | |
| 4 | | Other investment items | | | |
| 5 | Non-Tradable Intermediate Input | Storing cost | Freezing | | |
| 6 | | Capital | Cost of selling the sea buckthorn | Transportation | |
| 7 | | | Other intermediates | Improving the net of the fence | |
| 8 | | | sea buckthorn loan interest rate | | |
| 9 | | Labour | Labour for harvesting | | |
| 10 | | | Labour for selling | | |
| 11 | | | | Mowing | |
| 12 | | | | Pest control and rousing birds | |
| 13 | | | | Maintaining the fences | |
| 14 | | | | Cleaning the sea buckthorn tree area | |
| 15 | | | | Watering the sea buckthorn tree | |
| 16 | | Land | Annual land tax | | |
| 17 | | Tradable Intermediate Input | Storing cost | Vehicle fuel | |
| 18 | | | Capital | Sugar | |
| 19 | | | | Cost of selling the sea buckthorn | Plastic bags |
| 20 | | | | | Vehicle fuel |
| 21 | Other intermediates | | | buckets | |
| 22 | | Gloves | | | |

Source: Authors' own table

We consider four types of capital as fixed inputs: building irrigation canals, fencing, seedlings and other.

Appendix Table 12. Useful lives and salvage values of fixed inputs of Essay 2

| No | Inputs | Useful life (years) | Salvage value |
|----|---------------------------|---------------------|---------------|
| 1 | Building irrigation canal | 100* | 0** |
| 2 | Fencing | 25*** | 4%*** |
| 3 | Seedling | 30**** | 0** |
| 4 | Other investment items | 10** | 0** |

Source: * Controller Betty T. Yee (1976); **Assumed; *** Government of Mongolia (2005a); **** Li and McLoughlin (1997)

Appendix 4. Questionnaires

Questionnaire for Policy Analysis Matrix for Livestock Production – *Bulgan, Khovd-Mongolia* (Summer 2012)

(The original questionnaire is in Mongolian language)

(A) General information

1. Date _____ 2. Code _____ 3. Serial No. _____
4. Interviewer _____ 5. Translator _____
6. GPS position _____ 7. Camera photo NO _____
8. Location _____ 9. Subcounty name: _____ Code: 1=Bayangol; 2=Bayansudal;
3=Baitag; 4=Alag Tolgoi; 5= Dalt; 6=Burenkhairkhan;
10. Road Name/Direction from *Bulgan* Soum Centre _____ 11. House type _____
12. Phone number: _____
13. Name of household head: Last: _____ First: _____
14. Name of respondent: Last: _____ First: _____
15. Ethnicity of household:
Code: 1=Khalkh; 2=Zakhchin; 3=Kazakh; 4=Torguud; 5=Dorvod; 6=Urainhai; 7=Uuld; 8=Myangad;
9=Uzbek; 10=Tuva; 11=Bayad; 12=Uyghur; 13=Han Chinese; 14=Khoshuud; 15=Other (.....)
16. Does the household run livestock farming? Yes/No
17. Does the household run crop farming? Yes/No

(B) Household structure

18. Household structure

Note: Household defined as a group of persons who live together under the same roof and share a common source of food and income)

| NO | Name of household member | Gender (Code 1) | Age (years) | Relation with head (Code 2) | Marital status (Code 3) | Level of education (Code 4) | What is your main job during the year? (Code 5) | How often do you work in the current job this year (Code 6) | How many months of 2011 did he/she helped in livestock husbandry | How many years herding? | Whether earn regular money (salary) | If Child (6-18 years old), do you want to become herder in future (Yes/No) |
|----|--------------------------|-----------------|-------------|-----------------------------|-------------------------|-----------------------------|---|---|--|-------------------------|-------------------------------------|--|
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |

Code 1: 0=Male; 1=Female

Code 2: 1=Son or daughter; 2=Father or mother; 3=Grandchild; 4=Grandparents; 5=Father/Mother/Son/daughter in law; 6=Other relative; 7=Other non-relative

Code 3: 1=Unmarried; 2=Married 3=Widow/widower; 4=Divorced

Code 4: 1=No schooling; 2=Kindergarten; 3=Attended primary school; 4=Completed primary school; 5=Attended middle school; 6=Completed middle school; 7=Attended high school; 8=Completed high school; 9=College; 10=Undergraduate degree; 11= Master degree; 12=Ph.D or higher degree

Code 5: 1=Self-employed in agriculture; 2=Self-employed in non-farm activity; 3=Government employee; 4=Casual worker;
5=Salaried worker in agriculture; 6=Salaried worker in non-agriculture; 7=Domestic worker; 8=Student;
9=Unemployed looking for a job; 10=Unwilling to work or retired; 11=Unable to work (disabled); 12=Pupil

Code 6: 1=Few times; 2=Sometimes; 3=Always

19. What is the electrical supply? ___ Code: 1=No connection, 2=Shared connection, 3=Own connection, 4=Solar, 5=Other

20. Is your household a member of any organization (cooperative, group, herder group, community) Yes/No

21. If yes, please fill the details below?

| N | Name of organization | Type* | Annual charge (MNT) | Services/Activities (please write) | Supports (please write) |
|---|----------------------|-------|---------------------|------------------------------------|-------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

* Type of organization: 1=Cooperative; 2=Herder group; 3=Pasture use group; 4=Other (.....)

22. What is the source of drinking water? Code:

1=Rainwater, 2=Dam, 3=Pond or lake, 4=River or stream, 5=Spring, 6=Public-well, open, 7=Public well, sealed by pump, 8=Well in residence yard, 9=Piped public water, 10=Bore hole in residence, 11=Snow melt, 12=Other.....

(C) Crop Husbandry

23. Where do you grow your main crops? (Code)

Code:1=River Oases;2=Greenhouse;3=Large scale plantation (well irrigated); 4=Home garden; 5=Other (.....)

24. Do you hire people for field work? Yes/No

25. If so, how much did you pay for them in 2011 (MNT)?

26. Plot specific output data in 2011

| No of plot | Crop (Code 1) | Month of planting | Month of harvest | Quantity harvested | | From which used in | | | Average sold price per unit (MNT) | Sold to (Code 4) | How was the yield (Code 5) | Costs for land preparation (MNT) | Costs for seeds and planting (MNT) | Cultivated area (ha) | Owner of plot (Code 3) |
|------------|---------------|-------------------|------------------|--------------------|---------------|--------------------|------|-------|-----------------------------------|------------------|----------------------------|----------------------------------|------------------------------------|----------------------|------------------------|
| | | | | Quantity | Unit (Code 2) | Own consumption | Sale | Other | | | | | | | |
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |

Code 1: 1=Wheat; 2=Maize; 3=Rye; 4=Alfalfa; 5= Carrot; 6=Buckthorn; 7=Fruit trees; 8= Potato; 9= Cotton; 10=Cabbage; 11=Onion; 12=Watermelon; 13= Other (.....)

Code 2: 1=kg; 2=Liters; 3=Bundles; 4=Pieces; 5=Bags; 6=Container; 7=Other (.....)

Code 3: 1=Owned; 2=Rented for long term on contract with no rent; 3=Rented

Code 4: 1=Private dealer; 2=State Agency; 3=Friends; 4=Relatives; 5=Others (.....)

Code 5: 1=Good; 2=Average; 3=Below average; 4=Poor; 5=very poor; 6=total failure

27. Plot specific input data in 2011

| Code of plot | Crop* | Chemical fertilizer use | | | Organic fertilizer use | | | Do you apply mulch? (Yes/No) | Pesticide use | | |
|--------------|-------|-------------------------|----------|---------------|------------------------|----------|--------------|------------------------------|---------------|----------|--------------|
| | | Type (Code 1) | Quantity | Price per MNT | Type (Code 2) | Quantity | Price per KG | | Type | Quantity | Price per KG |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

*Please write the ID number of the plant types from above table.

Code 2: 1=Urea; 2=Triple super phosphate; 3=KCL; 4=NPK; 5=Other (.....)

Code 3: 1=Goat manure; 2=Sheep manure; 3=Cattle manure; 4=Camel manure; 5=Horse manure; 6= Yak manure; 7=Ashes; 8=Compost; 9=Mulch; 10=Poultry manure; 11=Other manure (.....)

28. Irrigation used in 2011 cultivation.

| No | Crop* | Amount per month | | Month of 2011 | Origin of the water (Code 1) | Type of irrigation (Code 2) | Salinization (Yes/No) |
|----|-------|------------------|------|---------------|------------------------------|-----------------------------|-----------------------|
| | | Quantity | Unit | | | | |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |

*Please write the ID number of the plant types from above table.

Code 1: 1=Well; 2=Spring; 3=River; 4=Tank; 5=Rain; 6=Lakes; 7=Reservoirs; 8=Wastewater; 9=Piped public water; 10=Snow melt; 11=Other (.....)

Code 2: 1=Flooding; 2=Localized; 3=Drip irrigation (surface); 4= Drip irrigation (underground); 5=Manual irrigation; 6=Sprinkler

30. For issues concerning farming practices, do you receive any support from somebody? Yes/No

31. If yes, what kind of support did you take by whom in 2011?

| Species | Reason to get the support or problems with plant production (Code 1) | Support by whom (Code 2) | What kind of support? | Total support (MNT) |
|-----------|--|--------------------------|-----------------------|---------------------|
| Vegetable | | | | |
| Fruit | | | | |
| Cereal | | | | |
| Other | | | | |

Code 1: 1= Weeds; 2=Pests and diseases; 3=Poor soil; 4= Time shortage; 5= Poor varieties/lack of seeds; 6= free roaming livestock; 8= Irrigation; 9=Other (.....)

Code 2: 1= Government; 2=NGOs; 3=Others (.....)

(D) Livestock husbandry

32. Livestock number in 2011 of this household (exclude livestock of others that are herded by this household)

| Species | Male | | | Female | | | Number of miscarriages | | Difference between now and before <i>Dzud</i> of 2009-2010 (Code) | Number of died livestock due to <i>Dzud</i> of 2009-2010 |
|---------|-----------------------------|--------------------|--------------------|-----------------------------|--------------------|--------------------|------------------------|------------------------------------|---|--|
| | Adult (2 or more years old) | Young (1 year old) | New born this year | Adult (2 or more years old) | Young (1 year old) | New born this year | In 2011 | In 2012 (Between January and June) | | |
| Goat | | | | | | | | | | |
| Sheep | | | | | | | | | | |
| Cattle | | | | | | | | | | |
| Camel | | | | | | | | | | |
| Horse | | | | | | | | | | |
| Yak | | | | | | | | | | |
| Other | | | | | | | | | | |

Code: 1=Increased; 2=Decreased; 3=Constant or no change

33. Did you work to herd someone else's livestock together with your livestock in 2011? Yes/No

34. If yes, how many livestock do you herd?

| Livestock | Number | | Herded livestock | | What products did you get from those livestock for your household? (Code) | What kind of return did you earn for herding one's livestock in 2011? | | | |
|-----------|--------|----------|------------------|-------------|---|---|---|---------------------------------|---------------|
| | Adult | New-born | Started month | Ended month | | Nothing (Yes/No) | Cash received per livestock per month (MNT) | Number of new born young animal | Other (.....) |
| Goat | | | | | | | | | |
| Sheep | | | | | | | | | |
| Cattle | | | | | | | | | |
| Horse | | | | | | | | | |
| Camel | | | | | | | | | |
| Total | | | | | | | | | |

Code: 1=Milk; 2=Meat; 3=Skin or hide; 4=Wool, cashmere, hair; 5=Riding or loading; 6=Other (.....)

35. Have your livestock herded by someone else in 2011? Yes/No

36. If yes, how many livestock was it?

| Livestock | Number of livestock herded by others | | | | | | Duration | | What kind of livestock products of these livestock did you give to the herder last year? | What kind of payment did you pay for the household who herded your livestock in 2011? | | | |
|-----------|--------------------------------------|--------------------|--------------------|-------------------------------|--------------------|--------------------|---------------|-------------|--|---|---|---------------------------------|---------------|
| | Male | | | Female | | | Started month | Ended month | | Nothing (Yes/No) | Cash paid per livestock per month (MNT) | Number of new born young animal | Other (.....) |
| | Adult (more than 2 years old) | Young (1 year old) | New born this year | Adult (more than 2 years old) | Young (1 year old) | New born this year | | | | | | | |
| Goat | | | | | | | | | | | | | |
| Sheep | | | | | | | | | | | | | |
| Cattle | | | | | | | | | | | | | |
| Horse | | | | | | | | | | | | | |
| Camel | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | |

Code: 1=Milk; 2=Meat; 3=Skin or hide; 4=Wool, cashmere, hair; 5=Riding or loading; 6=Other (.....)

37. Could you please specify the locations of pasturelands where you graze your livestock? (in spring, summer, autumn and winter Please write the names by the date from earliest you graze) MAP.

| Seasons | Location name | No | Pasture names | Distance between home and pasture (Êi) | People who usually herd (Code) |
|---------|---------------|----|---------------|--|--------------------------------|
| Spring | | | | | |
| | | | | | |
| | | | | | |
| Summer | | | | | |
| | | | | | |
| | | | | | |
| Autumn | | | | | |
| | | | | | |
| | | | | | |
| Winter | | | | | |
| | | | | | |
| | | | | | |

Code : 1=Hired herder; 2=Relatives; 3=Others (.....)

Note: if the person is a member of the family, please write the ID number of the member from table of 18th question in 1st page.

38. Nomadic movements

| From | To | Distance (km) | Livestock moving duration (days) | Packing and unpacking duration (hours) | |
|-------------|-------------|---------------|----------------------------------|--|-----------|
| | | | | Packing | Unpacking |
| Winter camp | Spring Camp | | | | |
| Spring camp | Summer camp | | | | |
| Summer camp | Autumn camp | | | | |
| Autumn camp | Winter camp | | | | |

39. How many times did you move in 2011? Spring.....; Summer.....; Autumn.....;Winter.....

40. Did your household made the *otor* in 2011?²²Yes/No

| Livestock | If yes, how many livestock was gone for otor? | Duration of otor (Days) | | | |
|-----------|---|-------------------------|--------|--------|--------|
| | | Spring | Summer | Autumn | Winter |
| Goat | | | | | |
| Sheep | | | | | |
| Cattle | | | | | |
| Horse | | | | | |
| Camel | | | | | |

41. How many people went for *otor* in 2011?

| No | Age* | Gender* | Whether assistant herder** (Yes/No) | Whether household member (Yes/No) |
|----|------|---------|-------------------------------------|-----------------------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |

*Note: if the person is a member of the family, please write the ID number of the member from table of 18th question in 1st page.

**Assistant herder means that the person who works for herder households and gets paid for his labor.

42. Pasture utilization in 2011

| Seasonal pasture | Duration of utilization | | Amount of yield /Code/ | | How enough is the pasture do you think nowadays? /Code/ | Number of households they used the same pastureland in 2011 |
|------------------|-------------------------|------------|------------------------|--------------------|---|---|
| | Started date | Ended date | Before utilization | End of utilization | | |
| Spring | | | | | | |
| Summer | | | | | | |
| Autumn | | | | | | |
| Winter | | | | | | |

Code: 1=Excellent; 2= Good; 3=Fair; 4=Poor; 5=very poor

²²*Otor* is Mongolian term stating that Going for very far pastures and for some days to graze better the livestock

43. How many hectare of hay-harvest area do you have?

| ID No | Name of hay-harvest land | Area (Ha) | Whether irrigated (Yes/No) | Whether fertilized (Yes/No) | Distance from home (KM) |
|-------|--------------------------|-----------|----------------------------|-----------------------------|-------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |

44. How much hay did your household prepare in 2011 (Ton)?

| Prepared hay (Ôñ) | From which used for own consumption (%) | From which sold percentage (%) | Was it enough? |
|-------------------|---|--------------------------------|----------------|
| | | | |
| | | | |
| | | | |
| | | | |

Code: 1=Ôèñ;0=ã¿é;

45. How many people went for hay harvest?

| Number | Gender* | Age | Whether household member? (Yes/No) | Duration (Days) | Which hay land did you harvest** | Used Machinery*** |
|--------|---------|-----|------------------------------------|-----------------|----------------------------------|-------------------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |

*0=Male; 1=Female (Note: if the person is a member of the family, please write the ID number of the member from table of 18th question in 1st page.)

**Please use the ID number of hay-land here from table

***0=Not used; 1=Tractor; 2=Truck; 3=Other (.....)

Water as for input for livestock production

46. What kind of water source do you use for the animals? (Code)

Spring.....;Summer.....; Autumn.....;Winter.....

Code: 1=River; 2=Own well; 3=Public well; 4=Other family's well; 5=Tank6=Lake7=Other

47. Do you have to pay for the water sources? (Yes/No) Spring.....; Summer.....; Autumn.....; Winter.....

48. If yes, how much did you pay per herd or animal? Spring.....; Summer.....; Autumn.....; Winter.....

49. Whom do you pay to? Spring.....; Summer.....; Autumn.....; Winter.....

50. What are the names of the water sources that you use?

- Spring.....;
- Summer.....;
- Autumn.....;
- Winter.....;

51. If your livestock go to river, how many times per day does your livestock go to the river?

| Spring | Summer | Autumn | Winter |
|--------|--------|--------|--------|
| | | | |

52. If you have own well, what was the extraction cost of it?..... (MNT) Extracted date:

53. If your livestock drink from well, how many times per day do you water them from the well?

| Spring | Summer | Autumn | Winter |
|--------|--------|--------|--------|
| | | | |

54. Forage

| Animal species | Type of forage (Code 1) | Origin of forage (Code 2) | Amount per day per animal (Kg) | Animal species | Type of forage (Code 1) | Origin of forage (Code 2) | Amount per day per animal (Kg) |
|----------------------|-------------------------|---------------------------|--------------------------------|----------------------|-------------------------|---------------------------|--------------------------------|
| Spring season | | | | Autumn season | | | |
| Cattle | | | | Cattle | | | |
| Goat | | | | Goat | | | |
| Sheep | | | | Sheep | | | |
| Camel | | | | Camel | | | |
| Horse | | | | Horse | | | |
| Yak | | | | Yak | | | |
| Summer season | | | | Winter season | | | |
| Cattle | | | | Cattle | | | |
| Goat | | | | Goat | | | |
| Sheep | | | | Sheep | | | |
| Camel | | | | Camel | | | |
| Horse | | | | Horse | | | |
| Yak | | | | Yak | | | |

Code 1: 1=Grazing pasture; 2=Cut fresh grass; 3=Grains; 4=Roaming around the house; 5=Residuals of harvest, 6=Tubers; 7=Cereal bran; 8=Meal leftovers; 9=Hay; 10=Salt; 11=Other components

Code 2: 1=Purchased; 2=Owned/self-produced; 3=Natural; 4=Aid; 5=Other (.....)

55. Did you buy fodder last year (2011)?Yes/No

56. If yes, please give me the details?

| No | Types of fodder | Month of the purchase* | Bought amount (KG) | Price per unit (MNT) | How much of them did you use? (%) | Whom did you buy from? | If you spent more costs other than the price, how much was it? (MNT) |
|----|-----------------|------------------------|--------------------|----------------------|-----------------------------------|------------------------|--|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

57. Did you buy hay last year (2011)?Yes/No

58. If yes, please give me the details?

| How many times did you buy? | Month of the purchase* | Bought amount (KG) | Price per unit (MNT) | How much of them did you use? (%) | Whom did you buy from? | If you spent more costs other than the price, how much was it? (MNT) |
|-----------------------------|------------------------|--------------------|----------------------|-----------------------------------|------------------------|--|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

59. For issues concerning livestock, do you receive support from government, NGOs or any other agricultural organisation?

60. If yes, please give us the details

| Species | Problems with livestock (Code 1) | Support by whom (Code 2) | What kind of support? | Total support (MNT) |
|---------|----------------------------------|--------------------------|-----------------------|---------------------|
| Sheep | | | | |
| Goat | | | | |
| Cattle | | | | |
| Horse | | | | |
| Camel | | | | |
| Yak | | | | |

Code 1: 1=Parasites; 2=Diseases; 3=Fodder scarcity; 4=Accidents and injuries; 5=Predation (snakes, wolves); 6=Too cold (small animals die); 7=Lack of drinking water; 8=Miscarriage; 9=Others (.....).

Code 2: 1= Government; 2=NGOs; 3=International organization; 4=Others (.....)

E. Socio-Economic, Policy Analysis

(E.1) Household production

E.1.1 Sale of livestock alive

61. How many times did you sell your **goats alive** in 2011? (please circle and give details)

| Number of sales | Month of the sale* | Number of sold goats | | Average weight (KG) | | Average price for one goat (MNT) | | Whom did you sell them? ** |
|-----------------|--------------------|----------------------|--------|---------------------|--------|----------------------------------|--------|----------------------------|
| | | Male | Female | Male | Female | Male | Female | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

62. How many times did you sell your **sheep alive** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Number of sold sheep | | Average weight (KG) | | Average price for one sheep (MNT) | | Whom did you sell them? ** |
|----------------|--------------------|----------------------|--------|---------------------|--------|-----------------------------------|--------|----------------------------|
| | | Male | Female | Male | Female | Male | Female | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

63. How many times did you sell your **cattle alive** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Number of sold cattle | | Average weight (KG) | | Average price for one cattle (MNT) | | Whom did you sell them? ** |
|----------------|--------------------|-----------------------|--------|---------------------|--------|------------------------------------|--------|----------------------------|
| | | Male | Female | Male | Female | Male | Female | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

64. How many times did you sell your **horses alive** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Number of sold horses | | Average weight (KG) | | Average price for one horse (MNT) | | Whom did you sell them?*** |
|----------------|--------------------|-----------------------|--------|---------------------|--------|-----------------------------------|--------|----------------------------|
| | | Male | Female | Male | Female | Male | Female | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

65. How many times did you sell your **camels alive** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Number of sold camels | | Average weight (KG) | | Average price for one camel (MNT) | | Whom did you sell them?*** |
|----------------|--------------------|-----------------------|--------|---------------------|--------|-----------------------------------|--------|----------------------------|
| | | Male | Female | Male | Female | Male | Female | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

E.1.2 Production and sale of meat

66. How many **goats** did you slaughter for meat and skin production in 2011? (please circle and give details)

| Products | Number of slaughtered goats | From which, used in | | |
|--------------------|-----------------------------|---------------------|-------|------------------------------------|
| | | Own consumption | Sale | Other purpose (gave as a gift etc) |
| Whole meat (Units) | | | | |
| Skin (Units) | | | | |

67. How many **slaughtered goats did you sell** in 2011? (please circle and give details)

| Number of sale | Products | Month of the sale | Number of slaughtered goats* | Average price per KG of meat and per unit of skin (MNT) | Whom did you sell them?*** |
|----------------|--------------------|-------------------|------------------------------|---|----------------------------|
| 1 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 2 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 3 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 4 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 5 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 6 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| Total | Whole meat (units) |  | ..... | - |  |
| | Skin (units) |  | ..... |  |  |

** Sum of slaughtered goats must be equal to 4th column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

68. How many **sheep** did you slaughter for meat and skin production in 2011?

| Products | Total slaughtered sheep | From which, used in | | |
|--------------------|-------------------------|---------------------|-------|----------------|
| | | Own consumption | Sale | Other purpose* |
| Whole meat (Units) | | | | |
| Skin (Units) | | | | |

*Other purposes: e.g. as a gift etc.

69. How many **slaughtered sheep did you sell** in 2011? (please circle and give details)

| Number of sale | Products | Month of the sale* | Number of slaughtered sheep** | Average price per KG of meat and per unit of skin (MNT) | Whom did you sell them?*** |
|----------------|--------------------|--------------------|-------------------------------|---|----------------------------|
| 1 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 2 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 3 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 4 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 5 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 6 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| Total | Whole meat (units) |  | ..... | - |  |
| | Skin (units) |  | ..... |  |  |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of slaughtered goats must be equal to 4th column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

70. How many **cattle** did you slaughter for meat and hide production in 2011?

| Products | Total slaughtered cattle | From which, used in | | |
|--------------------|--------------------------|---------------------|-------|----------------|
| | | Own consumption | Sale | Other purpose* |
| Whole meat (Units) | | | | |
| Hide (Units) | | | | |

*Other purposes: e.g. as a gift etc.

71. How many **slaughtered cattle did you sell** in 2011? (please circle and give details)

| Number of sale | Products | Month of the sale* | Number of slaughtered cattle** | Average price per KG of meat and per unit of skin (MNT) | Whom did you sell them?*** |
|----------------|--------------------|--------------------|--------------------------------|---|----------------------------|
| 1 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 2 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 3 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 4 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 5 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 6 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| Total | Whole meat (units) |  | ..... | - |  |
| | Skin (units) |  | ..... |  |  |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of slaughtered goats must be equal to 4th column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

72. How many **horses** did you slaughter for meat and hide production in 2011?

| Products | Total slaughtered horses | From which, used in | | |
|--------------------|--------------------------|---------------------|-------|----------------|
| | | Own consumption | Sale | Other purpose* |
| Whole meat (Units) | | | | |
| Hide (Units) | | | | |

*Other purposes: e.g. as a gift etc.

73. How many **slaughtered horses** did you sell in 2011? (please circle and give details)

| Number of sale | Products | Month of the sale* | Number of slaughtered horses** | Average price per KG of meat and per unit of skin (MNT) | Whom did you sell them?*** |
|----------------|--------------------|--------------------|--------------------------------|---|----------------------------|
| 1 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 2 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 3 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 4 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 5 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| 6 | Whole meat (units) | | | | |
| | Skin (units) | | | | |
| Total | Whole meat (units) |  | ..... | - |  |
| | Skin (units) |  | ..... |  |  |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of slaughtered goats must be equal to 4th column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

74. How many **camels** did you slaughter for meat and hide production in 2011?

| Products | Total slaughtered camel | From which, used in | | |
|--------------------|-------------------------|---------------------|-------|----------------|
| | | Own consumption | Sale | Other purpose* |
| Whole meat (Units) | | | | |
| Hide (Units) | | | | |

*Other purposes: e.g. as a gift etc.

75. How many **slaughtered camels** did you sell in 2011? (please circle and give details)

| Number of sale | Products | Month of the sale* | Number of slaughtered camels** | Average price per KG (MNT) | Whom did you sell them?*** |
|----------------|--------------------|--------------------|--------------------------------|----------------------------|----------------------------|
| 1 | Whole meat (units) | | | | |
| | Hide (units) | | | | |
| 2 | Whole meat (units) | | | | |
| | Hide (units) | | | | |
| 3 | Whole meat (units) | | | | |
| | Hide (units) | | | | |
| 4 | Whole meat (units) | | | | |
| | Hide (units) | | | | |
| Total | Whole meat (units) |  | ..... | - |  |
| | Hide (units) |  | ..... |  |  |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of slaughtered camels must be equal to 4th column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

E.1.3 Production and sale of milk

76. Goat milk

| Months of 2011 | What was the total amount of milk production last year (2011)? | | How did you use the milk that you produced last year (2011)? | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|--|--|--|----------|---|--------------------------------|
| | Number of milking goats | Average milk output per goat per day (Litre) | Own consumption (%) | Sale (%) | | |
| I | | | | | | |
| II | | | | | | |
| III | | | | | | |
| IV | | | | | | |
| V | | | | | | |
| VI | | | | | | |
| VII | | | | | | |
| VIII | | | | | | |
| IX | | | | | | |
| X | | | | | | |
| XI | | | | | | |
| XII | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Other
(.....)

77. Sheep milk

| Months of 2011 | What was the total amount of milk production last year (2011)? | | How did you use the milk that you produced last year (2011)? | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|--|---|--|----------|---|--------------------------------|
| | Number of milking sheep | Average milk output per sheep per day (Litre) | Own consumption (%) | Sale (%) | | |
| I | | | | | | |
| II | | | | | | |
| III | | | | | | |
| IV | | | | | | |
| V | | | | | | |
| VI | | | | | | |
| VII | | | | | | |
| VIII | | | | | | |
| IX | | | | | | |
| X | | | | | | |
| XI | | | | | | |
| XII | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Other
(.....)

78. Cow milk

| Months of 2011 | What was the total amount of milk production last year (2011)? | | How did you use the milk that you produced last year (2011)? | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|--|---|--|----------|---|--------------------------------|
| | Number of milking cows | Average milk output per cow per day (Litre) | Own consumption (%) | Sale (%) | | |
| I | | | | | | |
| II | | | | | | |
| III | | | | | | |
| IV | | | | | | |
| V | | | | | | |
| VI | | | | | | |
| VII | | | | | | |
| VIII | | | | | | |
| IX | | | | | | |
| X | | | | | | |
| XI | | | | | | |
| XII | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Other
(.....)

79. Camel milk

| Months of 2011 | What was the total amount of milk production last year (2011)? | | How did you use the milk that you produced last year (2011)? | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|--|---|--|----------|---|--------------------------------|
| | Number of milking camels | Average milk output per camel per day (Litre) | Own consumption (%) | Sale (%) | | |
| I | | | | | | |
| II | | | | | | |
| III | | | | | | |
| IV | | | | | | |
| V | | | | | | |
| VI | | | | | | |
| VII | | | | | | |
| VIII | | | | | | |
| IX | | | | | | |
| X | | | | | | |
| XI | | | | | | |
| XII | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Other
(.....)

80. Horse milk

| Months of 2011 | What was the total amount of milk production last year (2011)? | | How did you use the milk that you produced last year (2011)? | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|--|---|--|----------|---|--------------------------------|
| | Number of milking horses | Average milk output per horse per day (Litre) | Own consumption (%) | Sale (%) | | |
| I | | | | | | |
| II | | | | | | |
| III | | | | | | |
| IV | | | | | | |
| V | | | | | | |
| VI | | | | | | |
| VII | | | | | | |
| VIII | | | | | | |
| IX | | | | | | |
| X | | | | | | |
| XI | | | | | | |
| XII | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Other (.....)

E.1.4 Cashmere production

81. How much cashmere did you produce in 2011 excluding previous years reserved cashmere?

| Total cashmere produced (KG) | From which, used in (KG) | | |
|------------------------------|--------------------------|--------|---------------|
| | Own consumption* | Sale** | Other purpose |
| | | | |

*It means, the cashmere stored or not sold; but used for their own consumption

**It means, the cashmere sold amount only in 2011, excluding the sales of stored cashmere produced in previous years

82. How much cashmere did you sell that your household produced in 2011?

| No | Month of the sale | Price* (MNT/KG) | Sold amount of cashmere (KG)** | Could you explain the reason of different price you charged for selling your cashmere | Whom did you sell them?*** |
|-------|-------------------|-----------------|--------------------------------|---|----------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| Total | | | | | |

* It means that the price which is different for different quality of cashmere sold

** Sum of sold cashmere must be equal to 3rd column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

E.1.5 Wool and hair production and sale

Wool

83. How much **sheep wool** did you produce in 2011?

| Total amount (KG) | From which, used in (KG) | | |
|-------------------|--------------------------|-------|---------------|
| | Own consumption | Sale | Other purpose |
| | | | |

84. How many times did you sell **sheep wool** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Amount of sheep wool (KG)** | Average price per KG (MNT) | Whom did you sell them?*** |
|----------------|--------------------|-----------------------------|----------------------------|----------------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| Total | | | - | - |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of sold yak hair must be equal to 3rd column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

85. How much **camel wool** did you produce in 2011?

| Total amount (KG) | From which, used in (KG) | | |
|-------------------|--------------------------|-------|---------------|
| | Own consumption | Sale | Other purpose |
| | | | |

86. How many times did you sell **camel wool** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Amount of yak hair (KG)** | Average price per KG (MNT) | Whom did you sell them?*** |
|----------------|--------------------|---------------------------|----------------------------|----------------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| Total | | | - | - |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of sold yak hair must be equal to 3rd column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

Hair

87. How much **cattle hair** did you produce in 2011?

| Total amount (KG) | From which, used in (KG) | | |
|-------------------|--------------------------|-------|---------------|
| | Own consumption | Sale | Other purpose |
| | | | |

88. How many times did you sell **cattle hair** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Amount of yak hair (KG)** | Average price per KG (MNT) | Whom did you sell them?*** |
|----------------|--------------------|---------------------------|----------------------------|----------------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| Total | | | - | - |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of sold yak hair must be equal to 3rd column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

89. How much **horse hair and tail** did you produce in 2011?

| | | | |
|-------------------|--------------------------|-------|---------------|
| Total amount (KG) | From which, used in (KG) | | |
| | Own consumption | Sale | Other purpose |
| | | | |

90. How many times did you sell **horse hair and tail** in 2011? (please circle and give details)

| Number of sale | Month of the sale* | Amount of yak hair (KG)** | Average price per KG (MNT) | Whom did you sell them?*** |
|----------------|--------------------|---------------------------|----------------------------|----------------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| Total | | | - | - |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

** Sum of sold horse tail and hair must be equal to 3rd column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Other (.....)

E.1.6 Dairy production

91. How much dairy product did your household produce and sell in 2011?

| Dairy products | Amount of output | Used in, from which | | | | | | Own consumption | Other purpose** |
|-------------------------------|------------------|---------------------|---------------|-----------------------------|---------------|---------------------|---------------|-----------------|-----------------|
| | | Sale | | | | | | | |
| | | Amount | | Price per KG or litre (MNT) | | Whom did you sell?* | | | |
| | | Winter-Spring | Summer-Autumn | Winter-Spring | Summer-Autumn | Winter-Spring | Summer-Autumn | | |
| Dried curd (KG) | | | | | | | | | |
| Liquid curd (KG) | | | | | | | | | |
| Fermented mare's milk (Litre) | | | | | | | | | |
| Curd (Litre) | | | | | | | | | |
| Cheese (KG) | | | | | | | | | |
| Yellow fat oil (KG) | | | | | | | | | |
| Ygurt (Litre) | | | | | | | | | |
| Milk Distilled wodka (Litre) | | | | | | | | | |

*Buyer: 1=Private dealers; 2=State Agency; 3=Friends; 4=Relatives; 5=Other (.....)

**Other purposes: e.g. as a gift etc.

E.2 Input for livestock production

E.2.1 Labor

Livestock herding activities

92. How long does your livestock graze on the pastureland per day?

| | Spring | | Summer | | Autumn | | Winter | |
|------------------|--------|-----|--------|-----|--------|-----|--------|-----|
| | Start | End | Start | End | Start | End | Start | End |
| Duration (hours) | | | | | | | | |

93. If your household hired assistant herder(s), how long did you hire them in 2011? (Months)

94. If your household hired assistant herder(s), how much did you pay for them per month in 2011?

| | Spring | Summer | Autumn | Winter |
|------------|--------|--------|--------|--------|
| Cash (MNT) | | | | |
| Livestock | | | | |

Activities for livestock birth

95. In spring of 2011 and 2012, how many days did you spend to take care for survival?

| | Goatling | Lamb | Calf | Foal | Young camel | Yak calf |
|---------------------------|----------|------|------|------|-------------|----------|
| Days spent in 2011 spring | | | | | | |
| Days spent in 2012 spring | | | | | | |

96. During the livestock birth times of 2011 and 2012, how many people worked in the field?

| No | Who worked (Code1) | Age | | Gender (Code2) | | Number of days worked | |
|----|--------------------|------|------|----------------|------|-----------------------|------|
| | | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |

Code1 : 1=Father; 2=Son; 4=Mom; 5=Daughter; 7=Hired herder; 8=Relatives; 9=Others (.....)
Code2:0=Male; 1=Female

Activities related to producing meat, milk

Meat

97. How long does it take to slaughter the livestock and clean its offal?

| Livestock type | Duration to slaughter the livestock and prepare meat | | | Duration to clean offal | | |
|----------------|--|----------------------|-------|-------------------------|----------------------|-------|
| | Duration (hours) | How many people work | | Spent hours (hours) | How many people work | |
| | | Men | Women | | Men | Women |
| Goat | | | | | | |
| Sheep | | | | | | |
| Cattle | | | | | | |
| Horse | | | | | | |
| Camel | | | | | | |
| Yak | | | | | | |

98. Milking

| | Indicators | Months | | | | | | | | | | | |
|-------|---|--------|----|-----|----|---|----|-----|------|----|---|----|-----|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
| Goat | How many times do you milk per day? | | | | | | | | | | | | |
| | How long does it take to milk per goat per time? (Min) | | | | | | | | | | | | |
| | Milker | Male | | | | | | | | | | | |
| | | Female | | | | | | | | | | | |
| Sheep | How many times do you milk per day? | | | | | | | | | | | | |
| | How long does it take to milk per sheep per time? (Min) | | | | | | | | | | | | |
| | Milker | Male | | | | | | | | | | | |
| | | Female | | | | | | | | | | | |
| Cows | How many times do you milk per day? | | | | | | | | | | | | |
| | How long does it take to milk per cow per time? (Min) | | | | | | | | | | | | |
| | Milker | Male | | | | | | | | | | | |
| | | Female | | | | | | | | | | | |
| Horse | How many times do you milk per day? | | | | | | | | | | | | |
| | How long does it take to milk per horse per time? (Min) | | | | | | | | | | | | |
| | Milker | Male | | | | | | | | | | | |
| | | Female | | | | | | | | | | | |
| Camel | How many times do you milk per day? | | | | | | | | | | | | |
| | How long does it take to milk per camel per time? (Min) | | | | | | | | | | | | |
| | Milker | Male | | | | | | | | | | | |
| | | Female | | | | | | | | | | | |
| Yak | How many times do you milk per day? | | | | | | | | | | | | |
| | How long does it take to milk per yak per time? (Min) | | | | | | | | | | | | |
| | Milker | Male | | | | | | | | | | | |
| | | Female | | | | | | | | | | | |

99. Livestock breeding activities. How many young male livestock did you castrate last year (2011)?

| Livestock type | Number of livestock castrated | How long do you castrate per livestock? (Minute) | How many people worked for castration last year (2011) |
|----------------|-------------------------------|--|--|
| Goatling | | | |
| Lamb | | | |
| Calf | | | |
| Foal | | | |
| Young camel | | | |
| Yak calf | | | |

100.How many female livestock did you breed in 2011?

| Goat | Sheep | Cattle | Horse | Camel | Yak |
|------|-------|--------|-------|-------|-----|
| | | | | | |

Preparing fences, shelters, shed

101.How many people worked to clean the livestock shelter in last year (2011)?

| Seasons | How many times do you clean the shelter per season? | How long do you spend to clean the shelter in one time? (Hours) | How many people work to clean? | |
|---------|---|---|--------------------------------|--------|
| | | | Male | Female |
| Spring | | | | |
| Summer | | | | |
| Autumn | | | | |
| Winter | | | | |

102.How long time did you spend for repairing and fixing the shelters and facilities in 2011?

| Camps | Time spent (Hours) | How many people worked? | |
|-------------|--------------------|-------------------------|--------|
| | | Male | Female |
| Spring camp | | | |
| Summer camp | | | |
| Autumn camp | | | |
| Winter camp | | | |

E.2.2 Capital

Vehicles/Cartages

103.What vehicles/cartages does your household own?

| Indicators | Traktor | Truck | Car | Motorcycle | Bicycle | Other (.....) |
|--|---------|-------|-----|------------|---------|---------------|
| Amount | | | | | | |
| Whether they own (Yes/No) | | | | | | |
| Whether they rent (Yes/No) | | | | | | |
| Mark/Model | | | | | | |
| Load capacity (Ton) | | | | | | |
| Bought date | | | | | | |
| Type of engine* | | | | | | |
| Power of engine (1000 CC) | | | | | | |
| How often do you use them for your livestock husbandry** | | | | | | |
| How often used in hay and fodder preparation? | | | | | | |
| How often used in crop sector | | | | | | |
| Cost of purchase (MNT) | | | | | | |
| Current resale price if you sell it (MNT) | | | | | | |

*0=Petrol; 1=Diesel/Fuel

**1=Always; 2=often; 3=rarely; 4=Very rare; 5=Don't use

104. What was the maintenance cost of the vehicles in 2011? (MNT)

| Vehicles | Cost in Spring | Cost in Summer | Cost in Autumn | Cost in Winter | Cost of petrol (MNT) |
|---------------|----------------|----------------|----------------|----------------|----------------------|
| Traktor | | | | | |
| Truck | | | | | |
| Car | | | | | |
| Motorcycle | | | | | |
| Other (.....) | | | | | |

105. In 2011, how many livestock did you buy?

| Livestock type | Number of purchased livestock | Price per livestock (T) | What did you do with them?* |
|----------------|-------------------------------|-------------------------|-----------------------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

*1=Consumed in 2011; 2= Sold in 2011; 3= Restocking for our livestock; 4=Other (.....)

Electricity

106. If you get central electricity, how much did you pay in 2011? (MNT).....

107. Does your household have solar panel to get solar energy? Yes/No

108. If yes, please give the details?

| | |
|---|---|
| When did you buy it?* | ..... |
| How much did you pay for it? (MNT) | ..... |
| Type or mark of solar panel | ..... |
| Current resale price if you sell (MNT) | ..... |
| How often does your household use it a day? (hours/day) | Summer; Autumn; Winter; Spring..... |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

Real estates

109. What real estate do you have?

| Real estates | Possession of (Code) | Amount | If you bought when?* | How much did you pay? | Current resale price if sell (MNT) | How many months of the 2011 did you use it |
|---------------|----------------------|--------|----------------------|-----------------------|------------------------------------|--|
| House | | | | | | |
| Gers | | | | | | |
| Apartments | | | | | | |
| Land | | | | | | |
| Other (.....) | | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

Code 1=Bought; 2=Inherited; 3=Gift; 2=Renting; 3=Borrowed for free; 4=Don't have; 5=Built ourselves; 6=Renting land; 7= Other (.....)

110. If you rent above real estates, how much does the rent cost monthly? (MNT)

| Real estates | Monthly rent (MNT) | Is it leasing? (Yes/No) | If leasing, what is the interest rate per month? (%) |
|---------------|--------------------|-------------------------|--|
| House | | | |
| Gers | | | |
| Apartments | | | |
| Land | | | |
| Other (.....) | | | |

Items

111. Does your household own following items?

| Items | Own (Yes/No) | When did you buy it?* | How much did you pay? (MNT) | Current resale price if you sell (MNT) |
|------------------------|--------------|-----------------------|-----------------------------|--|
| TV | | | | |
| Radio | | | | |
| DVD player | | | | |
| Freezer | | | | |
| Fridge | | | | |
| Electric or gas cooker | | | | |
| Heater | | | | |
| Water pump | | | | |
| Sewing machine | | | | |
| Mower for grass | | | | |
| Other (.....) | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

112. Other items

| No | Items | If you bought when?* | How much did you pay? (MNT) |
|----|--|----------------------|-----------------------------|
| 1 | Scissors (e.g. for cutting livestock hair or wool etc) | | |
| 2 | Comb for cashmere | | |
| 3 | Stove and chimney | | |
| 4 | Bed | | |
| 5 | Chair | | |
| 6 | Table | | |
| 7 | Carpet | | |
| 8 | Kitchen stuff (items used in kitchen) | | |
| 9 | Other (.....) | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

Insurance

113. Did you insure your livestock in last year (2011)? Yes/No

114. If yes, please give the details?

| Livestock | Number of insured livestock | How much is monthly premium of the insurance per livestock? (MNT) | What does it cover? | Name of insurer |
|-----------|-----------------------------|---|---------------------|-----------------|
| Goat | | | | |
| Sheep | | | | |
| Cattle | | | | |
| Horse | | | | |
| Camel | | | | |

115. Do your household members pay health or social security insurance (2011)? Yes/No

116. If yes, please give me the details?

| | Health insurance | Social security | If missed to pay the monthly premium in 2011, how many months were missed? |
|--|------------------|-----------------|--|
| Number of insured household members | | | |
| Monthly insurance premium per month per person (MNT) | | | |

117. Did you insure your other assets? Yes/No

118. If yes, please give me the details?

| No | Insured items | Insured date | How much is insurance monthly premium? (MNT) | What does it cover? | Name of insurer |
|----|---------------|--------------|--|---------------------|-----------------|
| 1 | | | | | |
| 2 | | | | | |

Veterinary services: Vaccination

119. How many times did your livestock get vaccinated in 2011 and 2012 (between January and June of 2012)?

| Livestock | 11.....* | | 12.....* | | 13.....* | |
|-----------|----------------------|--------------------------------|----------------------|--------------------------------|----------------------|--------------------------------|
| | Dates of vaccination | Vaccinated number of livestock | Dates of vaccination | Vaccinated number of livestock | Dates of vaccination | Vaccinated number of livestock |
| Goat | | | | | | |
| Sheep | | | | | | |
| Cattle | | | | | | |
| Horse | | | | | | |
| Camel | | | | | | |

* Please write the vaccination name on the dots.

120. Please fill below table for more information.

| Number of vaccination times | Type of vaccination ^a | Who vaccinated ^b | Result ^c | Please write explanation of result (e.g. why did you evaluate the result as very poor etc.) |
|-----------------------------|----------------------------------|-----------------------------|---------------------|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

^a Please write the ID number of the vaccinations from above table here.

^b 1=All of them were professional; 2=All of them were unprofessional; 3=Some of them were professional 4=Do not know

^c 1=Excellent; 2=Good; 3=Moderate; 4=Poor; 5=Very poor

121. How many livestock died due to diseases in 2011?

| Livestock | Number of livestock got disease in 2011 | From which, number of died livestock | What disease was it? | Whether they were vaccinated (Yes/No)? | Month of death* |
|-----------|---|--------------------------------------|----------------------|--|-----------------|
| Goat | | | | | |
| Sheep | | | | | |
| Cattle | | | | | |
| Horse | | | | | |
| Camel | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

122. How many livestock died due to other reasons in 2011?

| Livestock | Number of died livestock | Reason of death* | What activities are taken to avoid from this kind of livestock loss |
|-----------|--------------------------|------------------|---|
| Goat | | | |
| Sheep | | | |
| Cattle | | | |
| Horse | | | |
| Camel | | | |

*1=Due to *Dzud*; 2=Stolen; 3=Eaten by predators e.g. wolves; 4=Sunk in river; 5=Other (.....)

Veterinary services: Medicines

123. Did you spend some money to buy livestock medicines in 2011? Yes/No

124.If yes, please give the details.

| No | Please write types of medicines | Amount | Measurement Unit | Cost per unit (MNT) |
|----|---------------------------------|--------|------------------|---------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |

Loan

125.Do you have any credit in a commercial bank?Yes/No

126.If yes please give the details below.

| No | Loan type | Date of credit taken* | Duration (months) | Amount of credit (MNT) | Monthly interest rate (%) | Deposit type** | Reason of credit to borrow | Name of Loan giver |
|----|-----------|-----------------------|-------------------|------------------------|---------------------------|----------------|----------------------------|--------------------|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |

**Date format: month/year e.g. 1/2011 means January of 2011 etc.

** 1=None; 2=Livestock; 3=Vehicle; 4=Real state; 5=Other

127.Has your household participated in Livestock Restocking Project implemented by Mongolian Government?

Yes/No

128.If yes, please give the details

| Livestock | Number of livestock given by the project as a loan | Money given for restocking (MNT) | Date loan given | Due date to payback* | Reason to get participated (Please write) |
|-----------|--|----------------------------------|-----------------|----------------------|---|
| Goat | | | | | |
| Sheep | | | | | |
| Cattle | | | | | |
| Horse | | | | | |
| Camel | | | | | |

*Date format: month/year e.g. 1/2011 means January of 2011 etc.

F.3 Additional information

Off-farm income

129.Does your household run any business other than the farming?Yes/No

130.If yes, please give the details below?

| N o | Please write the types business | Investment cost in 2011 (MNT) | Total output in 2011 | Output unit | Sold price per unit in 2011(MNT) |
|-----|---------------------------------|-------------------------------|----------------------|-------------|----------------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

131.Who did earn additional income among your household members in 2011?

| N | Name of household member who earns additional income | Source of income* | Monthly income (MNT) | Number of months that the member did not earn income in 2011 (Months) |
|---|--|-------------------|----------------------|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

*0=Constant job wage; 1=Contract Work; 2=Occasional jobs; 3=Mining; 4=Retailer; 5=Pension;

6=Money for disabled person; 7=Social allowances; 8=Social benefits; 9=Student grant of 500, 000 MNT

10=Student monthly grant 70,000 MNT; 11=Other (.....)

132. Did your household get any allowances, benefits, donations granted by state or an organization in 2011?
Yes/No

133. If yes, could you tell us the details?

| No | Grants type | Amount taken in 2011 | Unit of grant |
|----|-------------|----------------------|---------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

134. Did your household get any subsidy, that are unrelated to crop and livestock husbandry, from the government, or any organization in 2011? Yes/No

135. If yes, could you tell us the details?

| No | Subsidy type | Amount taken in 2011 | Unit of subsidy |
|----|--------------|----------------------|-----------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |

136. In 2011, what kind of taxes did you household pay?

| No | Tax type | Amount paid in 2011 |
|----|------------------------------|---------------------|
| 1 | Tax for wood for making fire | |
| 2 | Tax of gun | |
| 3 | ..... |  |
| 4 | ..... |  |
| 5 | ..... |  |
| 6 | ..... |  |

137. In summer of 2013, where would your household be?
1=In the same summer pasture; 2=Bulgan soum centre; 3=Don't know; 4=Other
(.....)

138. In last 5 years, where have you been grazed your livestock and where your HH stayed

| | 2012 | | 2011 | | 2010 | | 2009 | | 2008 | |
|--------|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|
| | Livestock | HH | Livestock | HH | Livestock | HH | Livestock | HH | Livestock | HH |
| Spring | | | | | | | | | | |
| Summer | | | | | | | | | | |
| Autumn | | | | | | | | | | |
| Winter | | | | | | | | | | |

139. (Ask this question if the HHH is in Soum Centre) Would you move to summer pasture in next years? (Yes/No)

140. Reason?

.....
.....

141. Are your HH exiting to be herder HH? (Yes/No)

142. If yes, why?

.....
.....

143. (Ask this question if the HHH is in Soum Centre) If the HH sent their livestock up to summer pasture herded by someone, who is this HH? (Code)

Code: 1=Relative; 2=Friend; 3=Someone else

Thank you very much for participating in our interview!

Questionnaire for Policy Analysis Matrix for Livestock Production – *Bulgan, Khovd-Mongolia*²³
(Summer 2013)

(The original questionnaire is in Mongolian language)

(A) General information (ASK ALL)

1. Date _____ 2. Code _____ 3. Interviewer _____
 4. GPS position _____ 5. Location _____ 6. Subcounty name: _____ Code: 1=Bayangol; 2=Bayansudal;
 3=Baitag; 4=Alag Tolgoi; 5= Dalt; 6=Burenkhairkhan;
 7. Name of household head: Last: _____ First: _____
 8. Name of respondent: Last: _____ First: _____

(B) Household structure (IF CHANGED)

9. Household structure **(IF CHANGED - If new member or if someone left the HHH since summer 2012)**

Note: Household defined as a group of persons who live together under the same roof and share a common source of food and income)

| NO | Code of household member | Gender (Code 1) | Age | Relation with head (Code 2) | Marital status (Code 3) | Level of education (Code 4) | Main job during the year (Code 5) | Months of 2012 helped in livestock husbandry | How many years herding? | Whether earn regular money (salary) (Yes/No) | Wether added* (Yes/No) |
|----|--------------------------|-----------------|-----|-----------------------------|-------------------------|-----------------------------|-----------------------------------|--|-------------------------|--|------------------------|
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |

(BOLD QUESTIONS TO BE FILLED IF THERE IS CHANGE HAS OCCURED TO A FAMILY MEMBER)

*This means that whether the family member is added (Yes) (Newborn, newcomers, adopted etc.) in the family as a new member or a family member is subtracted (No) (migrated, married, died etc) comparing to last summer.

Code 1: 0=Male; 1=Female

Code 2: 1=Son or daughter; 2=Father or mother; 3=Grandchild; 4=Grandparents; 5=Father/Mother/Son/daughter in law; 6=Other relative; 7=Other non relative

Code 3: 1=Unmarried; 2=Married 3=Widow/widower; 4=Divorced

Code 4: 1=Never attended; 2=Kindergarten; 3=Attended primary school; 4=Completed primary school; 5=Attended middle school; 6=Completed middle school; 7=Attended High school; 8=Completed High School; 9=College; 10=Undergraduate degree; 11= Master degree; 12=Ph.D or higher degree; 31=Attended college 32=Attended undergraduate degree; 33=Distant study for disabled person

Code 5: 1=Self-employed in agriculture; 2=Self-employed in non-farm enterprise; 3=Government employee; 4=Casual worker; 5=Salaried worker in agriculture; 6=Salaried worker in non-agriculture; 7=Domestic worker, 8=Student; 9=Unemployed looking for a job; 10=Unwilled to work or retired; 11=Unable to work (disabled); 12=Pupil

(C) Crop Husbandry

10. Plot specific output data in 2012 **(ASK ALL)**

| No | Crop (Code 1) | date of planting | Date of harvest | Quantity harvested | | From which used in | | | Average sold price per unit (MNT) | Sold to (Code 3) | Costs for land preparation (000 MNT) | Costs for seeds and planting (000 MNT) | Cultivated area (ha) |
|----|---------------|------------------|-----------------|--------------------|---------------|--------------------|------|-------|-----------------------------------|------------------|--------------------------------------|--|----------------------|
| | | | | Quantity | Unit (Code 2) | Own consumption | Sale | Other | | | | | |
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |

Code 1: 1=Wheat; 2=Maize; 3=Rye; 4=Alfalfa; 5= Carrot; 6=Buckthorn; 7=Fruit trees; 8= Potato; 9= Cotton; 10=Cabbage; 11=Onion; 12=Watermelon; 14=**Manjin**; 15=Wheat; 16=Tomato; 17=Cucumber; 19=**TINGA**; 20=Oats; 21=**BURGAS**

Code 2: 1=Kg; 2=Liters; 3=Bundles; 4=Pieces; 5=25 KG Bags; 6=Container; 8=50 KG Bags

Code 3: 1=Private dealer; 2=State Agency; 3=Friends; 4=Relatives; 5=Others (.....)

²³ Please note that, interviewer should ask all questions that have "(ASK ALL)". If the question is marked with "(IF CHANGED)" then ask first that information of this question is changed compared to last year, firstly. If the interviewee says that the information is changed, then the interviewer should ask those questions.

11. Plot specific input data in 2012 (ASK ALL)

| No | Crop* | Organic fertilizer use | | | Pesticide use | | |
|----|-------|------------------------|----------|--------------------|---------------|----------|--------------|
| | | Type (Code 1) | Quantity | Price per KG (MNT) | Type | Quantity | Price per KG |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |

*Please write the ID number of the plant types from above table.

Code 1:1=Goat manure; 2=Sheep manure; 3=Cattle manure; 4=Camel manure; 5=Horse manure; 6= Yak manure; 7=Ashes; 8=Compost; 9=Mulch; 10=Poultry manure; 11=Other manure (.....)

12. How many times did you water your crop or vegetable in 2012? (ASK ALL)

13. How many hours did you spend for watering your crop or vegetable for one time? (ASK ALL)

14. Who worked in crop farming in 2012? (ASK ALL)

| No | Code of household member | How many days worked? (Days) |
|----|--------------------------|------------------------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

15. For issues concerning farming practices, do you receive any support from somebody?(ASK ALL) Yes/No

16. If yes, what kind of support did you take in 2012? (ASK ALL)

17. How much was it in thousand MNT? (ASK ALL) (000 MNT)

(D) Livestock husbandry (ASK ALL)

18. Livestock number in 2012 of this household (exclude livestock of others that are herded by this household)

| Species | Male | | | Female | | | Number of miscarriages In 2013 (Between January and June) |
|---------|-----------------------------|--------------------|--------------------|-----------------------------|--------------------|--------------------|---|
| | Adult (2 or more years old) | Young (1 year old) | New born this year | Adult (2 or more years old) | Young (1 year old) | New born this year | |
| Goat | | | | | | | |
| Sheep | | | | | | | |
| Cattle | | | | | | | |
| Camel | | | | | | | |
| Horse | | | | | | | |

19. Did you work to herd someone else's livestock together with your livestock in 2012? (ASK ALL) Yes/No

20. If yes, how many livestock do you herd? (ASK ALL)

| Livestock | Number | | Herded duration | | What kind of return did you earn for herding one's livestock in 2012? | | | |
|-----------|--------|---------|-----------------|------------|---|---|---------------------------------|-----------------|
| | Adult | Newborn | Started date | Ended date | Nothing (Yes/No) | Cash received per livestock per month (MNT) | Number of new born young animal | Other (000 MNT) |
| Goat | | | | | | | | |
| Sheep | | | | | | | | |
| Cattle | | | | | | | | |
| Horse | | | | | | | | |
| Camel | | | | | | | | |
| Total | | | | | | | | |

21. Have your livestock herded by someone else in 2012?(ASK ALL) Yes/No

22. If yes, how many livestock was it? (ASK ALL)

| Livestock | Number of livestock herded by others | | | | | | Duration | | What kind of payment did you pay for the household who herded your livestock in 2012? | | | |
|-----------|--------------------------------------|--------------------|--------------------|-------------------------------|--------------------|--------------------|--------------|------------|---|---|---------------------------------|-----------------|
| | Male | | | Female | | | Started date | Ended date | Nothing (Yes/No) | Cash paid per livestock per month (MNT) | Number of new born young animal | Other (000 MNT) |
| | Adult (more than 2 years old) | Young (1 year old) | New born this year | Adult (more than 2 years old) | Young (1 year old) | New born this year | | | | | | |
| Goat | | | | | | | | | | | | |
| Sheep | | | | | | | | | | | | |
| Cattle | | | | | | | | | | | | |
| Horse | | | | | | | | | | | | |
| Camel | | | | | | | | | | | | |
| Total | | | | | | | | | | | | |

23. Could you please specify the locations of pasturelands where you graze your livestock? (IF CHANGED)

| Seasons | Location name | No | Pasture names | Distance between home and pasture (Êi) | People who usually herd (Code)* |
|---------|---------------|----|---------------|--|---------------------------------|
| Spring | | | | | |
| | | | | | |
| Summer | | | | | |
| | | | | | |
| Autumn | | | | | |
| | | | | | |
| Winter | | | | | |
| | | | | | |

* if the person is a member of the family, please write the ID number of the member from table of 9th question in 1st page.
Code : 1=Hired herder; 2=Relatives; 3=Others (.....)

24. Nomadic movements (IF CHANGED, ASK ALL)

| From | To | Distance (Km) | Livestock moving duration (days) | Means of Transport * | Total cost of movement (000 MNT) |
|-------------|-------------|---------------|----------------------------------|----------------------|----------------------------------|
| Winter camp | Spring Camp | | | | |
| Spring camp | Summer camp | | | | |
| Summer camp | Autumn camp | | | | |
| Autumn camp | Winter camp | | | | |

*1=by Camel; 2=by Truck

25. How many times did you move in 2012? (ASK ALL)

Spring.....; Summer.....; Autumn.....; Winter.....

26. Did your household made the *Otor* in 2012?²⁴(ASK ALL)Yes/No

27. If yes, please give the details of *Otor* (ASK ALL)

| Livestock | If yes, how many livestock was gone for <i>Otor</i> ? | Duration of otor (Days) | | | |
|-----------|---|-------------------------|--------|--------|--------|
| | | Spring | Summer | Autumn | Winter |
| Goat | | | | | |
| Sheep | | | | | |
| Cattle | | | | | |
| Horse | | | | | |
| Camel | | | | | |

²⁴*Otor* is Mongolian term stating that Going for very far pastures and for some days to graze better the livestock

28. How many people went for *otor* in 2012? (Please circle the number in first column) (ASK ALL)

| No | If household member, the Code of household member | How many days went for OTOR? | Age | Gender |
|----|---|------------------------------|-----|--------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

29. Pasture utilization in 2012 (ASK ALL)

| Seasonal pasture | Duration of utilization | |
|------------------|-------------------------|------------|
| | Started date | Ended date |
| Spring | | |
| Summer | | |
| Autumn | | |
| Winter | | |

30. How many hectare of hay-harvest area did you have in 2012? (IF CHANGED)

| ID No | Name of hay-harvest land | Area (Ha) | Whether irrigated (Yes/No) | Whether fertilized (Yes/No) | Distance from home (KM) |
|-------|--------------------------|-----------|----------------------------|-----------------------------|-------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |

31. How much hay did your household prepare in 2012?(ASK ALL)

| Prepared hay | | | Own consumption (%) | Sold | | Cost of renting truck (000 MNT) | Cost per hiring person per day (000 MNT) | How many people worked in how many days | Given as a donation (%) |
|--------------|-------|--------------|---------------------|------------|------------------------------|---------------------------------|--|---|-------------------------|
| Amount | Unit* | Ton per unit | | Amount (%) | Price hay (000 MNT per unit) | | | | |
| | | | | | | | | | |

*1=Тон; 2=Porter(3.5 тонн); 3=Зил 130; 4=Орос 66 машин; 5=Орос 66 чиргїлтэй

32. How many people went for hay harvest in 2012? (ASK ALL)

| No | Code of HH member | Gender* | Age | Duration (Days) | Used Machinery** | Whether hired (Yes/No) |
|----|-------------------|---------|-----|-----------------|------------------|------------------------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |

*0=Male; 1=Female (Note: if the person is a member of the family, please write the ID number of the member from table of 9th question in 1st page.)

** 0=Not used; 1=Tractor; 2=Truck; 3=Used horse to put in fence; 4=Used motorcycle to put in fence; 5=Horse hay harvesting machine; 6=Used camel to put in fence

Water as for input for livestock production

33. How many times did you water your livestock per day in 2012? (ASK ALL)

| Spring | Summer | Autumn | Winter |
|--------|--------|--------|--------|
| | | | |

34. If you extracted the well since summer 2012, what was the cost of it? (ASK ALL)..... (000 MNT)

35. Did you buy fodder last year (2012)?(ASK ALL)Yes/No

36. If yes, please give me the details? (ASK ALL)

| No | Types of fodder* | Date of the purchase | Bought amount (KG) | Price per unit (000 MNT) | How much of them did you use? (%) | If you spent more costs other than the price, how much was it? (000 MNT) |
|----|------------------|----------------------|--------------------|--------------------------|-----------------------------------|--|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |

*1=Wheat; 2=KHURZUN (Cumulated goat and sheep manure); 3=Salt; 4=Oats; 5=Allmash (fodders mixed);

6=Bran; 7=Bran with other ingredients; 8=Rye9=Other (.....)

37. Did you buy hay last year (2012)?(ASK ALL)Yes/No

38. If yes, please give me the details? (ASK ALL)

| How many times did you buy? | Date of the purchase | Bought amount (Trucks) | Price per Trucks (000 MNT) | How much of them did you use? (%) | If you spent more costs other than the price, how much was it? (000 MNT) |
|-----------------------------|----------------------|------------------------|----------------------------|-----------------------------------|--|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

39. For issues concerning livestock farming, do you receive any support from somebody? (ASK ALL)

Yes/No

40. If yes, what kind of support did you take in 2012? (ASK ALL)

41. How much was it in total? (ASK ALL) (000 MNT)

E. Socio-Economic, Policy Analysis

(E.1) Household production

E.1.1 Sale of livestock alive

42. How many times did you sell your **goats alive** in 2012? (ASK ALL)

| No of sales | Date of the sale | Number of sold goats | | Average price for one goat (000 MNT) | | Whom did you sell them? * | Whether they are small ²⁵ goats (Yes/No) | Whether they are female goats with calves (Yes/No) | Whether they are given to others for free (Yes/No) |
|-------------|------------------|----------------------|--------|--------------------------------------|--------|---------------------------|---|--|--|
| | | Male | Female | Male | Female | | | | |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Given as a donation to the Soum
7=Own children; 8=Sold to China

43. How many times did you sell your **sheep alive** in 2012? (ASK ALL)

| No of sales | Date of the sale | Number of sold sheep | | Average price for one sheep (MNT) | | Whom did you sell them? * | Whether they are small sheep (Yes/No) | Whether they are female sheep with calves (Yes/No) | Whether they are given to others for free (Yes/No) |
|-------------|------------------|----------------------|--------|-----------------------------------|--------|---------------------------|---------------------------------------|--|--|
| | | Male | Female | Male | Female | | | | |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Given as a donation to the Soum
7=Own children; 8=Sold to China

44. How many times did you sell your **cattle alive** in 2012? (ASK ALL)

| No of sale | Date of the sale | Number of sold cattle | | Age of cattle (years) | | Average price per cattle (000 MNT) | | Sold to* | Whether they are small cattle (Yes/No) | Whether they are cows with calves (Yes/No) | Whether they are given to others for free (Yes/No) |
|------------|------------------|-----------------------|--------|-----------------------|--------|------------------------------------|--------|----------|--|--|--|
| | | Male | Female | Male | Female | Male | Female | | | | |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Given as a donation to the Soum
7=Own children; 8=Sold to China

45. How many times did you sell your **horses alive** in 2012? (ASK ALL)

| No of sale | Date of the sale | Number of sold horse | | Age of horses (years) | | Average price per horse (000 MNT) | | Sold to* | Whether they are small horse (Yes/No) | Whether they are mares with calves (Yes/No) | Whether they are given to others for free (Yes/No) |
|------------|------------------|----------------------|--------|-----------------------|--------|-----------------------------------|--------|----------|---------------------------------------|---|--|
| | | Male | Female | Male | Female | Male | Female | | | | |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Given as a donation to the Soum
7=Own children; 8=Sold to China

²⁵ Small livestock means that the age of the livestock is younger than 1 year or newborn in spring of 2013.

46. How many times did you sell your **camels alive** in 2012? (ASK ALL)

| No of sale | Date of the sale | Number of sold camels | | Age of camel (years) | | Average price per camel (000 MNT) | | Sold to* | Whether they are small camel (Yes/No) | Whether they are female camel with calves (Yes/No) | Whether they are given to others for free (Yes/No) |
|------------|------------------|-----------------------|--------|----------------------|--------|-----------------------------------|--------|----------|---------------------------------------|--|--|
| | | Male | Female | Male | Female | Male | Female | | | | |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Given as a donation to the Soum
7=Own children; 8=Sold to China

E.1.2 Production and sale of meat

47. How many **goats** did you slaughter for meat and skin production in 2012? (ASK ALL)

| Products | Number of slaughtered goats | From which, used in | | |
|--------------------|-----------------------------|---------------------|-------|---------------------|
| | | Own consumption | Sale | Given as a donation |
| Whole meat (Units) | | | | |
| Skin (Units) | | | | |

48. How many **slaughtered goats** did you sell in 2012? (ASK ALL)

| | No of sale | Products | Month of the sale | Number of slaughtered goats* | Average price per KG of meat and per unit of skin (000 MNT) | Whom did you sell them?*** |
|-------|--------------------|--------------------|-------------------|------------------------------|---|----------------------------|
| 1 | 1 | Whole meat (units) | | | | |
| | 2 | Whole meat (units) | | | | |
| | 3 | Whole meat (units) | | | | |
| | 4 | Whole meat (units) | | | | |
| 2 | Spring | Skin (units) | | | | |
| | Summer | Skin (units) | | | | |
| | Autumn | Skin (units) | | | | |
| | Winter | Skin (units) | | | | |
| Total | Whole meat (units) |  |  | ..... | - |  |
| | Skin (units) |  |  | ..... |  |  |

* Sum of slaughtered goats must be equal to 4th column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Sell it on the market directly

49. How many **sheep** did you slaughter for meat and skin production in 2012? (ASK ALL)

| Products | Number of slaughtered sheep | From which, used in | | |
|--------------------|-----------------------------|---------------------|-------|---------------------|
| | | Own consumption | Sale | Given as a donation |
| Whole meat (Units) | | | | |
| Skin (Units) | | | | |

50. How many **slaughtered sheep** did you sell in 2012? (ASK ALL)

| | No of sale | Products | Month of the sale | Number of slaughtered sheep* | Average price per KG of meat and per unit of skin (000 MNT) | Whom did you sell them?*** |
|-------|--------------------|--------------------|-------------------|------------------------------|---|----------------------------|
| 1 | 1 | Whole meat (units) | | | | |
| | 2 | Whole meat (units) | | | | |
| 2 | Spring | Skin (units) | | | | |
| | Summer | Skin (units) | | | | |
| | Autumn | Skin (units) | | | | |
| | Winter | Skin (units) | | | | |
| Total | Whole meat (units) |  |  | ..... | - |  |
| | Skin (units) |  |  | ..... |  |  |

* Sum of slaughtered sheep must be equal to 4th column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Sell it on the market directly

51. How many **cattle** did you slaughter for meat and hide production in 2012? (ASK ALL)

| No | Total slaughtered cattle | From which, used in | | | | | | | | |
|-------------------------|--------------------------|---------------------|-----|---------|--------|-----|---------|---------------------|-----|---------|
| | | Own consumption | | | Sale | | | Given as a donation | | |
| | | Number | Age | Gender* | Number | Age | Gender* | Number | Age | Gender* |
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| Total (Hide/Whole meat) | | | | | | | | | | |

* 0= Male; 1=Female

52. How many **slaughtered cattle** did you sell in 2012? (ASK ALL)

| | No of sale | Products | Month of the sale | Number of slaughtered cattle* | Average price per KG of meat and per unit of skin (000 MNT) | Whom did you sell them?*** |
|-------|--------------------|--------------------|-------------------|-------------------------------|---|----------------------------|
| 1 | 1 | Whole meat (units) | | | | |
| | 2 | Whole meat (units) | | | | |
| | 3 | Whole meat (units) | | | | |
| 2 | Spring | Skin (units) | | | | |
| | Summer | Skin (units) | | | | |
| | Autumn | Skin (units) | | | | |
| | Winter | Skin (units) | | | | |
| Total | Whole meat (units) |  |  | ..... | - |  |
| | Skin (units) |  |  | ..... |  |  |

* Sum of slaughtered cattle must be equal to 4th column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Sell it on the market directly

53. How many **horses** did you slaughter for meat and hide production in 2012? (ASK ALL)

| No | Total slaughtered horses | From which, used in | | | | | | | | |
|-------------------------|--------------------------|---------------------|-----|---------|--------|-----|---------|---------------------|-----|---------|
| | | Own consumption | | | Sale | | | Given as a donation | | |
| | | Number | Age | Gender* | Number | Age | Gender* | Number | Age | Gender* |
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| Total (Hide/Whole meat) | | | | | | | | | | |

* 0= Male; 1=Female

54. How many **slaughtered horses** did you sell in 2012? (Please circle and give details) (ASK ALL)

| | No of sale | Products | Month of the sale | Number of slaughtered horse* | Average price per KG of meat and per unit of skin (000 MNT) | Whom did you sell them?*** |
|-------|--------------------|--------------------|-------------------|------------------------------|---|----------------------------|
| 1 | 1 | Whole meat (units) | | | | |
| | 2 | Whole meat (units) | | | | |
| | 3 | Whole meat (units) | | | | |
| 2 | Spring | Skin (units) | | | | |
| | Summer | Skin (units) | | | | |
| | Autumn | Skin (units) | | | | |
| | Winter | Skin (units) | | | | |
| Total | Whole meat (units) |  |  | ..... | - |  |
| | Skin (units) |  |  | ..... |  |  |

* Sum of slaughtered horses must be equal to 4th column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Sell it on the market directly

55. How many **camels** did you slaughter for meat and hide production in 2012? (ASK ALL)

| No | Total slaughtered camels | From which, used in | | | | | | | | |
|-------------------------|--------------------------|---------------------|-----|---------|--------|-----|---------|---------------|-----|---------|
| | | Own consumption | | | Sale | | | Other purpose | | |
| | | Number | Age | Gender* | Number | Age | Gender* | Number | Age | Gender* |
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| Total (Hide/Whole meat) | | | | | | | | | | |

* 0= Male; 1=Female

56. How many **slaughtered camels did you sell** in 2012? (please circle and give details) (ASK ALL)

| | No of sale | Products | Month of the sale | Number of slaughtered camel* | Average price per KG of meat and per unit of skin (000 MNT) | Whom did you sell them?*** |
|-------|--------------------|--------------------|-------------------|------------------------------|---|----------------------------|
| 1 | 1 | Whole meat (units) | | | | |
| | 2 | Whole meat (units) | | | | |
| 2 | Spring | Skin (units) | | | | |
| | Summer | Skin (units) | | | | |
| | Autumn | Skin (units) | | | | |
| | Winter | Skin (units) | | | | |
| Total | Whole meat (units) |  |  | ..... | - |  |
| | Skin (units) |  |  | ..... |  |  |

* Sum of slaughtered camels must be equal to 4th column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Sell it on the market directly

E.1.3 Production and sale of milk

57. Goat milk (ASK ALL)

| Months of 2012 | Amount of milk production in 2012 | | From which | | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|-----------------------------------|--|-------------------------|--------------|-----------------------------|---|--------------------------------|
| | Number of milking goats | Average milk output from all goats per day (Litre) | Own consumption (Litre) | Sold (Litre) | Given as a Donation (Litre) | | |
| I | | | | | | | |
| II | | | | | | | |
| III | | | | | | | |
| IV | | | | | | | |
| V | | | | | | | |
| VI | | | | | | | |
| VII | | | | | | | |
| VIII | | | | | | | |
| IX | | | | | | | |
| X | | | | | | | |
| XI | | | | | | | |
| XII | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Final customers

58. Sheep milk (ASK ALL)

| Months of 2012 | Amount of milk production in 2012 | | From which | | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|-----------------------------------|--|-------------------------|--------------|-----------------------------|---|--------------------------------|
| | Number of milking sheep | Average milk output from all sheep per day (Litre) | Own consumption (Litre) | Sold (Litre) | Given as a Donation (Litre) | | |
| I | | | | | | | |
| II | | | | | | | |
| III | | | | | | | |
| IV | | | | | | | |
| V | | | | | | | |
| VI | | | | | | | |
| VII | | | | | | | |
| VIII | | | | | | | |
| IX | | | | | | | |
| X | | | | | | | |
| XI | | | | | | | |
| XII | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Final customers

59. Cow milk (ASK ALL)

| Months of 2012 | Amount of milk production in 2012 | | From which | | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|-----------------------------------|---|-------------------------|--------------|-----------------------------|---|--------------------------------|
| | Number of milking cows | Average milk output from all cows per day (Litre) | Own consumption (Litre) | Sold (Litre) | Given as a Donation (Litre) | | |
| I | | | | | | | |
| II | | | | | | | |
| III | | | | | | | |
| IV | | | | | | | |
| V | | | | | | | |
| VI | | | | | | | |
| VII | | | | | | | |
| VIII | | | | | | | |
| IX | | | | | | | |
| X | | | | | | | |
| XI | | | | | | | |
| XII | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Final customers

60. Camel milk (ASK ALL)

| Months of 2012 | Amount of milk production in 2012 | | From which | | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|-----------------------------------|---|-------------------------|--------------|-----------------------------|---|--------------------------------|
| | Number of milking camels | Average milk output from all camels per day (Litre) | Own consumption (Litre) | Sold (Litre) | Given as a Donation (Litre) | | |
| I | | | | | | | |
| II | | | | | | | |
| III | | | | | | | |
| IV | | | | | | | |
| V | | | | | | | |
| VI | | | | | | | |
| VII | | | | | | | |
| VIII | | | | | | | |
| IX | | | | | | | |
| X | | | | | | | |
| XI | | | | | | | |
| XII | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Final customers

61. Horse milk (ASK ALL)

| Months of 2012 | Amount of milk production in 2012 | | From which | | | Average price sold milk (MNT per litre) | Whom did you sell them mostly* |
|----------------|-----------------------------------|---|-------------------------|--------------|-----------------------------|---|--------------------------------|
| | Number of milking horses | Average milk output from all horses per day (Litre) | Own consumption (Litre) | Sold (Litre) | Given as a Donation (Litre) | | |
| I | | | | | | | |
| II | | | | | | | |
| III | | | | | | | |
| IV | | | | | | | |
| V | | | | | | | |
| VI | | | | | | | |
| VII | | | | | | | |
| VIII | | | | | | | |
| IX | | | | | | | |
| X | | | | | | | |
| XI | | | | | | | |
| XII | | | | | | | |

*Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Contracted bodies; 6=Sold via their shops; 7=Other (.....)

E.1.4 Cashmere production (ASK ALL)

62. How much cashmere did you produce in 2012 excluding previous year's cashmere? (ASK ALL)(KG)

63. How much cashmere did you sell that your household produced in 2012? (ASK ALL)

| No | Date of the sale | Price* (MNT/KG) | Sold amount of cashmere (KG)** | Whom did you sell them?*** |
|-------|------------------|-----------------|--------------------------------|----------------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| Total | | | | |

* It means that the price which is different for different quality of cashmere sold

** Sum of sold cashmere must be equal to 3rd column of the above table (highlighted in gray).

***Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Wool cooperative; 7=Sold in China; 8=Sold in UB; 9=Organization

E.1.5 Wool and hair production and sale

Wool

64. How much **sheep wool** did you produce in 2012? (ASK ALL)

| Total amount (KG) | From which, used in (KG) | | | |
|-------------------|--------------------------|-------|-----------------------------|-------------|
| | Own consumption | Sale | Given as donation to others | Thrown away |
| | | | | |

65. How many times did you sell **sheep wool** in 2012? (please circle and give details) (ASK ALL)

| No of sale | Date of the sale | Amount of sheep wool (KG)* | Average price per KG (MNT) | Whom did you sell them?*** | If participated in Wool Subsidy Programme, how much did you get? (000 MNT) |
|------------|------------------|----------------------------|----------------------------|----------------------------|--|
| 1 | | | | | |
| 2 | | | | | |
| Total | | | - | - | |

* Sum of sheep wool hair must be equal to 3rd column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Company; 7=Sold in China; 8=Sold in UB; 9=Organization

66. How much **camel wool** did you produce in 2012? (ASK ALL)

| Total amount (KG) | From which, used in (KG) | | |
|-------------------|--------------------------|-------|-----------------------------|
| | Own consumption | Sale | Given as donation to others |
| | | | |

67. How many times did you sell **camel wool** in 2012? (please circle and give details) (ASK ALL)

| No of sale | Date of the sale | Amount of sheep wool (KG)* | Average price per KG (MNT) | Whom did you sell them?*** | If participated in Wool Subsidy Programme, how much did you get? (000 MNT) |
|------------|------------------|----------------------------|----------------------------|----------------------------|--|
| 1 | | | | | |
| 2 | | | | | |
| Total | | | - | - | |

* Sum of camel wool hair must be equal to 3rd column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Company; 7=Sold in China; 8=Sold in UB; 9=Organization

Hair

68. How much **cattle hair** did you produce in 2012? (ASK ALL)

| Total amount (KG) | From which, used in (KG) | | |
|-------------------|--------------------------|-------|---------------|
| | Own consumption | Sale | Other purpose |
| | | | |

69. How many times did you sell **cattle hair** in 2012? (please circle and give details) (ASK ALL)

| No of sale | Month of the sale* | Amount of cattle hair (KG)** | Average price per KG (MNT) | Whom did you sell them?*** |
|------------|--------------------|------------------------------|----------------------------|----------------------------|
| 1 | | | | |
| Total | | | - | - |

* Sum of sold cattle hair must be equal to 3rd column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Company; 7=Sold in China; 8=Sold in UB; 9=Organization

70. How much **horse hair and tail** did you produce in 2012? (**ASK ALL**)

| Total amount (KG) | From which, used in (KG) | | |
|-------------------|--------------------------|------|---------------|
| | Own consumption | Sale | Other purpose |
| | | | |

71. How many times did you sell **horse hair and tail** in 2012? (please circle and give details) (**ASK ALL**)

| Number of sale | Month of the sale | Amount of horse hair and tail (KG)* | Average price per KG (MNT) | Whom did you sell them?*** |
|----------------|-------------------|-------------------------------------|----------------------------|----------------------------|
| 1 | | | | |
| Total | | | - | - |

* Sum of sold horse tail and hair must be equal to 3rd column of the above table (highlighted in gray).

**Buyer: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Final customers directly; 6= Company; 7=Sold in China; 8=Sold in UB; 9=Organization

E.1.6 Dairy production

72. How much dairy product did your household produce and sell in 2012? (**ASK ALL**)

| Dairy products | Amount of output | | | Used in, from which | | | | | | Own consumption | Given as a donation |
|---------------------------------------|------------------|---------------------|-------|---------------------|------|-----------------------------|------|---------------------|--|-----------------|---------------------|
| | Produced | Taken (as Donation) | Total | Sale | | | | Whom did you sell?* | | | |
| | | | | Amount | | Price per KG or litre (MNT) | | | | | |
| A | B | C=A+B | W-Sp | Su-A | W-Sp | Su-A | W-Sp | Su-A | | | |
| Dried curd (KG) | | | | | | | | | | | |
| Fermented Mare's milk (Litre) | | | | | | | | | | | |
| Curd (Litre) | | | | | | | | | | | |
| Liquid curd (<i>Aarts/Boz</i>) (KG) | | | | | | | | | | | |
| Cheese (KG) | | | | | | | | | | | |
| Clarified butter (KG) | | | | | | | | | | | |
| Yogurt (Litre) | | | | | | | | | | | |
| <i>Nermel</i> vodka (Litre) | | | | | | | | | | | |
| Fermented camel milk (Litre) | | | | | | | | | | | |

Note: W-Sp = Winter-Spring; Su-A= Summer-Autumn

*Buyer: 1=Private dealers; 2=State Agency; 3=Friends; 4=Relatives; 5=To final customer (e.g. on market); 6=Someone's shop; 7=Contracted person (by order); 8=Sold in Qinghe (participated in Exhibition); 9=Sold near to the road for passengers of the vehicles passing through;

E.2 Input for livestock production

E.2.1 Labor

Livestock herding activities

73. If you hired assistant herder, please give the details. (**ASK ALL**)

| | Gender | Number | Duration (months) | Monthly salary (000 MNT) |
|-------------------|--------|--------|-------------------|--------------------------|
| Assistant herders | Male | | | |
| | Female | | | |

Activities related to producing cashmere, wool, hair, dairy products

74. Labour input for cashmere, wool, hair and hide (**ASK ALL**)

| Products | How long does it take to cut (to take the skin/hide off) it from one livestock (minute) |
|---------------------|---|
| Goat cashmere | |
| Sheep wool | |
| Camel wool | |
| Horse hair and tail | |
| Cattle hair | |
| Skin/Hide of | Goat |
| | Sheep |
| | Cattle |
| | Horse |
| | Camel |

75. Labour input for dairy products (**ASK ALL**)

| Dairy products | How long would it take to produce unit of the dairy product (Hours) | How much milk is to be used to produce a unit of dairy product (Litre) |
|---------------------------------------|---|--|
| Dried curd (KG) | | |
| Fermented Mare's milk (Litre) | | |
| Curd (Litre) | | |
| Liquid curd (<i>Aarts/Boz</i>) (KG) | | |
| Cheese (KG) | | |
| Clarified butter (KG) | | |
| Yogurt (Litre) | | |
| <i>Nermel</i> vodka (Litre) | | |
| Fermented camel milk (Litre) | | |

E.2.2 Capital

Vehicles/Cartages

76. What vehicles/cartages do your household own? (**IF CHANGED**)

| Indicators | Traktor | Truck | Car | Motorcycle | Horse hay harvest machine |
|--|---------|-------|-----|------------|---------------------------|
| Amount | | | | | |
| Mark/Model* | | | | | |
| Bought date | | | | | |
| Power of engine (1000 CC) | | | | | |
| How often do you use them for your livestock husbandry** | | | | | |
| How often used in hay and fodder preparation? | | | | | |
| How often used in crop sector | | | | | |
| Cost of purchase (MNT) | | | | | |
| Current resale price if you sell it (MNT) | | | | | |

- *1 Mayti 1.5 6 Accent 11 Small tractor (*Pad Pad*) 16 Porter
 2 Challenger Jeep 7 Japanese 12 YUM-6 tractor 17 Forgon truck
 3 Chinese 8 ZIL 130 truck 13 IJ Planeta 5 motorcycle 18 UAZ truck
 4 Russian motorcycle 9 69 truck 14 66 Truck 19 Mazda Titan
 5 American 10 Bongo-Porter 15 Toyota Land Cruiser 80
- ** 1=Always; 2=Often; 3=Rarely; 4=Very rare; 5=Don't use

77. What was the maintenance cost of the vehicles in 2012? (MNT) (**ASK ALL**)

| Vehicles | Maintenance cost in 2012 (000 MNT) | Cost of petrol (000 MNT) |
|---------------------------|------------------------------------|--------------------------|
| Traktor | | |
| Truck | | |
| Car | | |
| Motorcycle | | |
| Horse hay harvest machine | | |

78. In 2012, how many livestock did you buy or taken for free from others? (**ASK ALL**)

| Livestock type | Livestock age | Number of purchased livestock | Price per livestock (000 MNT) | Number of livestock taken as a gift | What did you do with them?* |
|----------------|---------------|-------------------------------|-------------------------------|-------------------------------------|-----------------------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

- *1=Consumed in 2012; 2= Sold in 2012; 3= Restocking for our livestock; 4=Slaughtered, then sold the meat and skin
 5= Gave it to other person 6=Other (.....)

Electricity

79. If you get central electricity, how much did you pay in 2012?(**ASK ALL**)..... (000 MNT)

80. Does your household have solar panel to get solar energy?(**IF CHANGED**)Yes/No

81. If yes, please give the details? **(IF CHANGED)**

| | |
|---|---|
| When did you buy it? | ..... |
| How much did you pay for it? (MNT) | ..... |
| Current resale price if you sell (MNT) | ..... |
| How often does your household use it a day? (hours/day) | Summer; Autumn; Winter; Spring..... |

Real estates

82. What real estate do you have? **(IF CHANGED since summer 2012)**

| Real estates | Possession* | Amount | Bought date | How much did you pay, if bought? (000 MNT)** | How many months of the 2012 did you use it |
|---------------|-------------|--------|-------------|--|--|
| House | | | | | |
| Gers | | | | | |
| Apartments | | | | | |
| Land | | | | | |
| Other (.....) | | | | | |

*1=Bought; 2=Inherited; 3=Gift; 2=Renting; 3=Borrowed for free; 4=Don't have; 5=Built ourselves; 6=Renting land; 7= Other (.....)

** If built yourself, please write the cost of building in total.

Items

83. Does your household own following items? **(IF CHANGED if changed since summer 2012)**

| Items | Number of item | Bought date | How much did you pay? (000 MNT) |
|-------------------------------------|----------------|-------------|---------------------------------|
| 1. TV (Information) | | | |
| 2. Radio | | | |
| 3. MP3 or DVD player or TV receiver | | | |
| 4. Freezer | | | |
| 5. Fridge | | | |
| 6. Electric or gas cooker | | | |
| 7. Heater | | | |
| 8. Water pump | | | |
| 9. Sewing machine | | | |
| 10. Mover for grass | | | |
| 11. Washing machine | | | |
| 12. Other (.....) | | | |

84. Other items **(IF CHANGED since summer 2012)**

| No | Items | Number | Bought date | How much did you pay? (000 MNT) |
|----|---------------------------------------|--------|-------------|---------------------------------|
| 1 | Scissors (e.g. for cutting wool etc) | | | |
| 2 | Comb for cashmere | | | |
| 3 | 1. Big stove with chimney | | | |
| | 2. Stove with chimney | | | |
| 4 | Bed | | | |
| 5 | Chair | | | |
| 6 | Table | | | |
| 7 | Carpet | | | |
| 8 | Kitchen stuff (items used in kitchen) | | | |
| 9 | Woolen matras | | | |
| 10 | Kazakh carpet | | | |
| 11 | Other (.....) | | | |

Insurance

85. Did you insure your livestock in last year (2012)? **(ASK ALL)** Yes/No

86. If yes, please give the details? **(ASK ALL)**

| Livestock | Number of insured livestock | How much is monthly premium of the insurance per livestock? (MNT) | What does it cover? | Name of insurer |
|-----------|-----------------------------|---|---------------------|-----------------|
| Goat | | | | |
| Sheep | | | | |
| Cattle | | | | |
| Horse | | | | |
| Camel | | | | |

Veterinary services: Vaccination

87. Did you pay for any livestock vaccination to State Veterinary Services? (ASK ALL) Yes/No

88. If yes, how much was it in total in 2012? (ASK ALL) (000 MNT)

89. How many livestock died due to diseases in 2012? (ASK ALL)

| Type of livestock | Age of livestock | Number of died livestock due to disease | Disease name* |
|-------------------|------------------|---|---------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

* 1=Эргий 6=Хорттой ногоо идсэн 11=Герэлтийн хийдрэл
 2=2 Нид нь сохорсон 7=Гэдэс нь хөсгөд ихсэн 12=Ётөнд баригдсан-Ётсөн
 3=Халуурсан 8=АМРУУ 13=СОХОР ДОГОЛОН
 4=Яр гарсан 9=Гийлгэх, баас алдах, ногооны хордлого 14=Нид нь мултарч ихсэн
 5=ДУУТ 10=Хачигны хамуу 15=Тураалд орж ихсэн

90. How many livestock died due to other reasons in 2012? (ASK ALL)

| Livestock | Age of livestock | Number of died livestock due to non disease reasons | Reason of death* |
|-----------|------------------|---|------------------|
| | | | |
| | | | |
| | | | |
| | | | |

* 1=Due to *Dzud*; 2=Stolen; 3=Eaten by predators e.g. wolves; 4=Sunk in river; 5=Ate poisonous grass and died
 6=Died in metal fences; 7=Killed by someone; 8=Lost with no reason (stolen); 9=Eaten by dogs (after *Dzud* it increased)

Veterinary services: Medicines

91. Did you spend some money to buy livestock medicines in 2012? (ASK ALL) Yes/No

92. If yes, please give the details. (ASK ALL)

| No | Please write types of medicines | Amount | Measurement Unit* | Cost per unit (000 MNT) |
|----|---------------------------------|--------|-------------------|-------------------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |

* 1=Bottle (500 gram) 2=Stomach pain relief medicine for young calves 3=Ivanbek (Big bottle) 4=Bottle (100 gram) 5=Litre 6=Units

Loan

93. Did you take loan from any commercial bank or others since summer of 2012? (ASK ALL) Yes/No

94. If yes please give the details below. (ASK ALL)

| No | Loan type* | Date of credit taken | Duration (months) | Amount of credit (000 MNT) | Monthly interest rate (%) | Deposit type** | Reason of credit to borrow**** | Name of Loan giver*** |
|----|------------|----------------------|-------------------|----------------------------|---------------------------|----------------|--------------------------------|-----------------------|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |

* 1=Business loan 2=Herder's loan 3=Loan of Mercy-Cor 4=Wage loan 5=Pension loan 6=Loan from individuals 7=Loan from the Project "Dairy products"

** 1=None; 2=Livestock; 3=Vehicle; 4=Real state; 5=Other (.....)

*** 1= Khan Bank 2= Mercy-Cor 3 =Savings Bank 4 =Mongol Post bank 5 =Individual

**** 1= To buy house 2= To buy livestock 3= To go to UB (Other.....) 4= To fund my UG student cost
 5= Wedding of relatives 6= Donation for others 7= To run small business to buy livestock and sell them as a meat
 8= Medical cost for family member 9= To pay the loan 10= To go to UB

F. Additional information

Off-farm income

95. Does your household run any business other than the farming in 2012? **(ASK ALL)** Yes/No

96. If yes, please give the details below? **(ASK ALL)**

| No | Types business* | Investment cost in 2012 (000 MNT) | Total output in 2012 | Output unit | Sold price per unit in 2012 (000 MNT) |
|----|-----------------|-----------------------------------|----------------------|-------------|---------------------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

- *1=Business of "Billiard Place" 7= Making roof the *gers* (**yrts**) 13= Making horse-stirrup
 2= Transportation service by truck 8= Making big blocks by mud 14= Making a wire made from hides
 3= Artisanal gold mining 9= Going for fire wood 15= Making a snaffle
 4= Work in construction 10= Building a house 16= Making sheep wool wire for Belt of Ger
 5= Money from wrestling competitions for wining 11= Transport fire wood by own truck 17= Making wire made from cattle and horse hair
 6= Making breaks 12= Transport the hay by own truck

97. Who did earn additional income among your household members in 2012? **(ASK ALL)**

| N | Name of household member who earns additional income | Source of income* | Monthly income (000 MNT) | Number of months that the member did not earn income in 2012 (Months) |
|---|--|-------------------|--------------------------|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |

- *0=Constant job wage; 1=Contract Work; 2=Occasional jobs; 3=Mining; 4=Retailer; 5=Pension;
 6=Money for disabled person; 7=Social allowances; 8=Social benefits; 9=Student grant of 500,000 MNT
 10=Student monthly grant 70,000 MNT; 11= College students Grant of 45000 MNT ; 12=Earned working in UB
 13=Prize money of winning in horse race; 14=Other (.....)

98. Did your household get any allowances, benefits, donations, supports from any organization in 2012? **(ASK ALL)** Yes/No

99. If yes, could you tell us the details? **(ASK ALL)**

| No | Grants type | Amount taken in 2012 (000 MNT) |
|----|--------------|--------------------------------|
| 1 | Food Voucher | |
| 2 | ..... |  |

100. In 2012, what kind of taxes did you household pay? **(ASK ALL)**

| No | Tax type* | Amount paid in 2012 (000 MNT) |
|----|-----------|-------------------------------|
| 1 | | |
| 2 | | |
| 3 | | |

- *1=Tax of fire wood 6=Tax of business (e.g. Billiard business) 11=Tax of TV
 2=Tax of gun 7=Tax of hay harvest land 12=Tax of TV receiver
 3=State Rent of land 8=Tax of natural resource extraction (salt, onion) 13=Tax of cutting Spring Bushes
 4=Tax of Truck/Car 9=Tax of land of spring camp 14=Tax of **BUUTS** (cumulated livestock manure)
 5=Tax of Motorcycle 10=.....

Thank you very much for participating in our interview!

Interview Questionnaire of competitiveness of sea buckthorn (SB) – *Bulgan, Khovd Province Mongolia*

(Summer 2014)

(The original questionnaire is in Mongolian language)

(A) General Information

1. Date _____ 2. Code _____ 3. Interviewer _____ 4. Phone: _____
 5. GPS point: _____ 6. Camera photo ID: _____
 7.1 Location of interview held: _____ 7.2 Location of SB farm: _____
 8. Subcounty name: _____ Code: 1=Bayangol; 2=Bayansudal; 3=Baitag; 4=Alag Tolgoi; 5=Dalt; 6=Burenkhairkhan;
 9. Name of household head: Last: _____ First: _____
 10. Name of respondent: Last: _____ First: _____

(B) Household structure

11. Household structure

Note: Household defined as a group of persons who live together under the same roof and share a common source of food and income)

| N | Code of household member | Gender (Code 1) | Age | Relation with head (Code 2) | Level of education (Code 4) | Main job during the year (Code 5) | Whether earn regular money (salary) (Yes/No) | If yes, income earned in 2013 | | |
|---|--------------------------|-----------------|-----|-----------------------------|-----------------------------|-----------------------------------|--|-------------------------------|------------------|---------------------------|
| | | | | | | | | Monthly salary/pension (MNT) | Number of Months | Source of income (Code 7) |
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

Code 1: 0=Male; 1=Female

Code 2: 1=Son or daughter; 2=Father or mother; 3=Grandchild; 4=Grandparents;

5=Father/Mother/Son/daughter in law; 6=Other relative; 7=Other non-relative

Code 4: 1=Never attended; 2=Kindergarten; 3=Attended primary school; 4=Completed primary school; 5=Attended middle school;

6=Completed middle school; 7=Attended High school; 8=Completed High School; 9=College;

10=Undergraduate degree; 11=Master degree; 12=Ph.D or higher degree;

Code 5: 1=Self-employed in agriculture; 2=Self-employed in non-farm enterprise; 3=Government employee; 4=Casual worker;

5=Salaried worker in agriculture; 6=Salaried worker in non-agriculture; 7=Domestic worker, 8=Student; 9=Unemployed looking for

a job; 10=Unwilling to work or retired; 11=Unable to work (disabled); 12=Pupil

Code 7: 0=Monthly wage; 1=Contracted work; 2=Casual work; 3=Mining; 4=Trade; 5=Pensionarie;

(Q131) 6=Allowance for disable people; 7=Social benefits; 8=Benefits and donations; 9=500,000 MNT for students; 10=70,000 MNT monthly student stipend; 11=Other (.....)

(C) Harvest and sale of sea buckthorn berry

12. Sea buckthorn tree, its berry harvest, and sales

| started year to grow or plant | Age of SB seedling when planted | Initial number of SB seedlings | | Last number of SB trees in 2013 | | Type of SB (Code 1) | Date of plantation | | Unit cost of SB (MNT) | Output per unit of SB tree (KG) | Harvested volume of SB berry (KG) | | From which, sold (KG) | | Sold price per KG of SB berry (MNT/KG) | | Sold to whom (Code 2) | | |
|-------------------------------|---------------------------------|--------------------------------|--------|---------------------------------|--------|---------------------|--------------------|----------|-----------------------|---------------------------------|-----------------------------------|------|-----------------------|------|--|------|-----------------------|------|--|
| | | Male | Female | Male | Female | | Started | Finished | | | 2012 | 2013 | 2012 | 2013 | 2012 | 2013 | 2012 | 2013 | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Зэрлэг чацаргана | | | | | | | | | | | | | | | | | | | |

Code 1: 1=*Uvs Ulaangom*; 2=*Chandmani*; 3=*Khovdiin Chuskaya*; 4=*Chinese*; 5=*Wild natural*

6=*Wild natural SB area was fenced, no plantation or growing but naturally it was there*; 7=*Others*

Code 2: 1=*Dealers or retailers*; 2=*State Agency*; 3=*Friends*; 4=*Relatives*; 5=*Unknown individual*; 6=*Other (.....)*

13. Labour for sea buckthorn berry harvest

| Date of SB berry harvest in 2013 | | Number of people worked for harvest | Of which, number of hired people worked for harvest | Cost of hiring people for harvest | | Duration to harvest per person per SB tree (Hours) |
|----------------------------------|----------|-------------------------------------|---|-----------------------------------|-------------|--|
| Started | Finished | | | Payment (MNT) | Unit (Code) | |
| | | | | | | |

Code 1=*Per person per day*; 2=*Per person per hour*; 3=*Per person per kg of harvested SB berry*

14. Cost of storing the SB berry after harvest

| Items | Quantity | Unit | Purchased year | Unit cost (MNT) |
|-------------------------|----------|------|----------------|-----------------|
| 1. Cost of vehicle fuel | | | - | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |

15. Labour for selling the SB berry in 2013

| Date of sale | | Number of people who sold the SB berry | Duration of selling (days) |
|--------------|----------|--|----------------------------|
| Started | Finished | | |
| | | | |

16. Cost of selling the SB berry in 2013

| Items | Quantity | Unit | Purchased year | Unit cost (MNT) |
|-------------------------|----------|------|----------------|-----------------|
| 1. Cost of vehicle fuel | | | - | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |

17. Items used for other intermediate after harvesting SB berry in 2013

| Items | Quantity | Unit | Purchased year | Unit cost (MNT) |
|---------|----------|------|----------------|-----------------|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |

18. Labour of maintaining the SB farming since SB farming started

| Type of labour | Number of people worked | | | | Worked hours per person per day | | | | Number of worked days | | | |
|---|-------------------------|------|------|------|---------------------------------|------|------|------|-----------------------|------|------|------|
| | 2010 | 2011 | 2012 | 2013 | 2010 | 2011 | 2012 | 2013 | 2010 | 2011 | 2012 | 2013 |
| labour of mowing grass around SB tree | | | | | | | | | | | | |
| labour of destroying insects and rousing birds around SB tree | | | | | | | | | | | | |
| labour of security checking around fences of SB trees | | | | | | | | | | | | |
| labour of cleaning waste and dropped branches around SB tree | | | | | | | | | | | | |

(D) Cost during sea buckthorn farming

19. Land type and characteristics

| Land size (Ha) | Soil type (Code) |
|----------------|------------------|
| | |

Code:1=Sandy; 2=Stony;3=Grassy;4=Muddy;5=Other (.....)

* If the farm land is the same as the land where this interview is taken, then it should be coded as 1.

20.1 Information about irrigation canals. Year Labour cost (MNT) Capital cost (MNT)

20.2 Irrigation system

| Year | Type of water used for watering SB tree (Code) | How many times watered? | How many people water per time? | Total spent hours for all people worked for watering SB tree per time? |
|------|--|-------------------------|---------------------------------|--|
| 2009 | | | | |
| 2010 | | | | |
| 2011 | | | | |
| 2012 | | | | |
| 2013 | | | | |

Code:1=Well water by hand;2=River water by hand;3=Well/river water by pump;4=Irrigation chanel from river water; 5=No watering (natural rain or snow);6=Other (.....)

(E) Investment cost of sea buckthorn berry farming

21. Land cost

| Date of land own/licensed (fenced) | Initial cost of land purchase/possess (000 MNT)* | Land payment/rent per year (000 MNT)* | Wether owned (Code) | Whether licensed (Code) |
|------------------------------------|--|---------------------------------------|---------------------|-------------------------|
| | | | | |

*If the land is not purchased and do not pay for land rent then the field must be entered as “0”.

Code: 0=No;1=Yes

Cost of fencing

22. Cost of materials/capitals for building fences

| Poles to make fence | | Netting materials | | | | barbed wire | | |
|---------------------|-----------------|-------------------|------|---------------------|-----------------|-------------|------|-----------------|
| Number (units) | Unit cost (MNT) | Number | Unit | Type of net? (Code) | Unit cost (MNT) | Number | Unit | Unit cost (MNT) |
| | | | | | | | | |

Code:1=Big net;2=Small net;3=Other (.....)

23. Labour for building fences

| Number of people worked | Of which number of hired people | Cost of labour | | Number of days worked |
|-------------------------|---------------------------------|------------------|-------------|-----------------------|
| | | Cost per persone | Unit (Code) | |
| | | | | |

Code: 1=Per person per day;2=Per person per hour;3=Per person per meter of fence built; 4=Other (.....)

24. Other costs for building fences

| Transportation cost (MNT) | Vehicle fuel cost | | | Food cost (MNT) |
|---------------------------|-------------------|----------------------|------------------|-----------------|
| | Amount (Litre) | Cost per litre (MNT) | Total cost (MNT) | |
| | | | | |

25. Transportation cost of seedling (MNT)

26. Labour for preparing the land and planting

| Hours to dig hole for per SB tree per persone | Number of people worked for digging holes | Of which, number of hired people | Number of days worked for digging for all of these people together | Average salary per person per day for hired people (000 MNT) |
|---|---|----------------------------------|--|--|
| | | | | |

27. Other costs of investment items

| Items | Type | Quantity | Unit | Unit cost (MNT) | Transportation cost (MNT) |
|----------------|------|----------|------|-----------------|---------------------------|
| 1.Fertilizer | | | | | |
| 2.Shovel | | | | | |
| 2.Bucket | | | | | |
| 3. 200L bucket | | | | | |
| 4. Grub axe | | | | | |
| 5. Grub hoe | | | | | |
| 6. | | | | | |
| 7. | | | | | |
| 8. | | | | | |
| 9. | | | | | |
| 10. | | | | | |

(F) Additional Information

28. What level do you agree with following statements about challenges for sea buckthorn farming?

| Challenges for sea buckthorn farming | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Lack of support from government (inc. local gov at county and province) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of capacity to process the SB berry | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of capacity to store the SB berry after harvest | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of knowledge to run SB berry farming among local people | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of finance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| SB berry farming requires long time to earn profit after first investment or planting | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Birds that eat the SB berry before harvest | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

29. Did you sell seedlings of sea buckthorn in 2012 or 2013 Yes/No

30. If yes, fill the below table

| Year of plantation | Age of seedlings | Number of seedlings sold | | Unit price per seedling sold (MNT/unit) | | Sold to whom? (Code) | |
|--------------------|------------------|--------------------------|------|---|------|----------------------|------|
| | | 2012 | 2013 | 2012 | 2013 | 2012 | 2013 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Code: 1=Dealers or retailers; 2=State Agency; 3=Friends; 4=Relatives; 5=Unknown individual; 6= Other (.....)

31. Have you ever get the cash or non-cash support for sea buckthorn farming? Yes/No

32. If yes, what kind of support was it?

| Nº | Organization provided the supports | What kind of support was it? | Total support (MNT) |
|----|------------------------------------|------------------------------|---------------------|
| 1 | | | |
| 2 | | | |

33. Have you get loan for sea buckthorn farming? Yes/No

34. If yes, please fill below table.

| Nº | Amount of loan take for SB farming (MNT) | Annual interest rate of loan (%) | Loan taken date | Duration of loan (months) | Lender | Whether repayment of the loan (Yes/No) |
|----|--|----------------------------------|-----------------|---------------------------|--------|--|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |

Thank you very much for participating in our interview!