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Small-scale producers in modern agrifood markets

Agrifood Sector Studies

Smallholder farmers' participation in restructuring markets: The beef subsector in Zambia (B)

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Smallholder farmers' participation in restructuring beef value chains in Zambia: A case study of the small-scale beef producers in Namwala district, Southern province, Zambia

Working Paper

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1 Abstract

Zambia's beef industry is highly concentrated; dominated with few agribusiness firms. There has been a decline in the role of government within the beef industry supply chain. The modern meat processor companies such as Zambeef and ZAM ZAM have taken over the control of beef supply chains from the government's remit. This has created several opportunities for small-scale cattle farmers by providing a ready and viable market for their animals. A two stage econometric model was used to evaluate the determinants of market channel choices among small-scale beef producers in Zambia using the case study of Namwala district in the Southeast province of the country.

The results of the first stage of the model shows that agricultural training and distance from the abattoirs (proxy for market access) are significant in determining smallholder farmers' market channel choices. The second stage model results indicate that channel choices made has no impact on incomes from beef or input use level. The overall results of the econometric model suggest that there are no distinct socio-economic characteristics between farmers participating in either modern or traditional markets. This means that farmers supplying beef to the formal markets are generally indifferent to those farmers supplying to traditional markets.

The future of smallholder farmers' participation in the beef value chains in Zambia has great potential. However for such potential to be realized there is need for the public and/or private sector to support small-scale beef farmers through subsidies on inputs, pest and disease control programs, infrastructure and training.

2 Introduction

Cattle production plays an important role in rural households' livelihoods through provision of employment, draught power and manure for crop production. Cattle are also a main source of food and cash for most rural households (Tembo 2002, Chilonda, *et al.* 2000). Most of the beef produced in rural areas is supplied through informal markets, such as local butcheries, or directly to consumers, especially in the informal rural markets. Other small-scale producers, however, sell their beef to intermediaries, such as meat wholesalers or commercial farmers who in turn supply to the formal beef market channels.

The beef sector has huge potential to contribute to the growth of agriculture especially among small-scale farmers. However, its current performance in terms of its potential contribution to food security and income generation has not been satisfactory. This has been a result of a number of constraints facing small-scale farmers such as poor access to markets and finance (credit), inadequate infrastructure, inconsistency in the government's agricultural policy framework, widespread livestock diseases, high cost of feed, and a high prevalence of HIV/AIDS (Chilonda and Machete, 2006). The potential of small-scale farmers in the beef sector is also threatened by low productivity characterized by slow growth rates (five to eight years to reach market weight), high calf and adult mortality rates (20-30 per cent and 9 per cent respectively) and low productive performance. Low productivity is exhibited through low conception and calving rates (less than 50 per cent in most rural areas) and long calving intervals. Hicks (1991) concluded that the introduction of a more intensive cattle production system is imperative to save ecological and social collapse in the rural areas. This could be achieved through integrated breeding and production systems aimed at increasing milk and meat production through the use of dual-purpose cattle breeds. Increased beef productivity may help Zambia to move away from its dependence on copper to a more balanced diversified economy.

Tembo (2002) in his study on commercial beef demand concluded that the future of the beef industry was apparently inauspicious. The trend line obtained showed that the quantity of beef demanded would decline by 2,565 heads of cattle per year. This implied that the extent of the market would decrease, and in turn become smaller. Small markets usually yield high costs, as producers cannot utilize economies of scale. Subsequently, high producer costs would be passed on to the consumers in the form of high beef prices, which would further constrain the development of the beef industry. The study conducted by Morgan (1997) concluded that beef's competitiveness is threatened by less expensive alternative meat products such as pork and poultry. Beef

is thus losing its market share globally. This loss of market share is tied directly to the rapid advances in the production of feed grain other than forages. Corn yield has increased fivefold from the early 1900s whereas lucerne yields have increased only by 60 per cent (Daka, 2002).

There have been several changes in the country's beef sub-sector following independence. Before liberalization Zambia's economic policies were based on monopolistic public institutions characterized by stringent price controls. This resulted in centralization of support services and increased state dominance in the agriculture sector, especially through the use of extensive subsidies. The Zambian government made efforts through the Cold Storage Board of Zambia (CSBZ) to increase the supply of beef by providing incentives to farmers in the construction of pens and paddocks and disease control through national beef schemes, and improved marketing. During the structural adjustment programs of the 1990s, the beef sub-sector went through rapid changes from being a state-dominated sector to a relatively liberalized market economy in which the private sector played a significant role (Ndiyoi & Mudenda, 2006).

This development has compelled some of the motivated small-scale farmers to strive to meet the quality and quantity demands associated with the modern markets (abattoirs). However some of these small-scale farmers have remained in the traditional markets, where quality and food safety standards are ignored with the consequential negative price effects. As a result small-scale farmers' net returns in their beef production enterprise have remained stagnant and relatively low due to the poor quality grade and weight. The traditional sector still controls 85 per cent of the national beef herd and provides about 40 per cent of domestic beef supply (Tembo, 2002). The emergence of restructured beef markets in the form of private abattoirs has brought the need for value addition through processing raw meat into several by-products. This has improved the share of formal agribusiness in the beef value chain, resulting in increased concentration and integration of the different stages of the beef value chain in Zambia.

Several studies have been carried out on the effects of market changes on smallholder farmers. Dolan & Humphrey (2000) concluded that modernization has, for the greater part, benefitted only a small group of high-capacity suppliers and has largely excluded smallholder producers. However, some studies indicated that foreign direct investment (FDI) has positive spillover effects for smallholder farmers (Dries & Swinnen, 2004; Key & Runsten, 1999). A study by Neven, *et al.* (2006) on smallholder dairy farmers in Zambia's Southern province concluded that farmers in the modern dairy channel grew faster in terms of milk output volumes as well as in terms of upgrading; with respect to improved breeds, tools, and operational management practices compared to farmers in the traditional dairy channel.

3 Research objectives and hypotheses

The central objective of this paper is to establish small-scale farmers' position in the Zambian beef value chain using the case of smallholder farmers of Namwala district in the Southern Province of Zambia. In addition, this study evaluates the factors influencing smallholder market channel choices and the impact of such choices on income and input use.

The specific research objectives of this study are:

- To establish the supply chain relationships, focusing on smallholder farmers' participation in the beef value chain.
- To evaluate factors which determine small scale farmers' market channel choice.
- To determine the impacts of the farmers' market channel choice on income and input use.

There are several hypotheses which need to be tested and these include the following:

- Hypothesis 1 - There are weak supply relationships between smallholder beef producers and the formal agribusiness supply channels.
- Hypothesis 2 - Household characteristics such as age, farm size, gender and education level have significant influence on small-scale beef producers' market channel choice.
- Hypothesis 3 - Collective action among farmers and access infrastructure are significant in determining small-scale beef farmers' market channel choice.
- Hypothesis 4 - Market channel choice has significant impact on income from cattle as well as technology use.

4 Research methodology

The study was conducted in 19 agricultural camps¹ in five agricultural blocks² in the Namwala district in the Southern province of Zambia. Namwala's town centre is located 156 kilometres west of Monze town and 336 kilometres from the country's capital Lusaka. This district is an important traditional livestock-producing district in Zambia; with relatively equal presence of both traditional and modern supply chains.

A two stage sampling approach was used for selecting households for the questionnaire survey. In the first sampling stage a population framework was compiled using a list of beef farmers provided by the veterinary and the police records in Namwala. The first sampling stage produced a population framework list of 400 smallholder beef producers. From this framework a total of 120³ small-scale livestock farmers were randomly selected in the second sampling stage.

A semi-structured questionnaire was used to elucidate information on smallholder farmers' participation in the Zambian beef value chain. The questionnaire contained both qualitative and quantitative questions. It was administered by trained enumerators, processed and cleaned using SPSS version 13 and the model was estimated using STATA version nine. In addition to the household survey, several interviews were administered with different stakeholders in the beef supply chain which included meat processors, service providers, farmer organizations and government officials.

¹ Namwala Central, Bambwe, Shamutonko, Mbeza, Katenwa, Kawezyi, Mayonda, Mafutu, Maiya, Maunga, Kalundu, Chitongo, Chibotu, Maala, Mukashampumbu, Luubwe, Nazhila, Kachinka, Mwise, Basanga, and Namubanga

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³ Decided arbitrary to select 30 per cent of the total population of beef farmers in the district.

5 Results and discussions

5.1 Value chain analysis

The beef supply chain in Zambia has been undergoing structural changes over time. Initially, the beef sub-sector was controlled by the government and eventually liberalized to become a free market regime. The beef supply chain has become increasingly vertically integrated; dominated by feedlot systems with their own abattoirs and retail outlets. The share of the traditional sector in the formal beef market is relatively small compared to the commercial sector, which accounts for 54 per cent of the formal beef markets especially in urban sales.

A result of these structural changes is that presently in Zambia two parallel supply chains exist; formal and the informal chains. The formal sector consists of large beef processors that have integrated both backwards and forwards thereby managing almost the whole supply chain. Most beef processing plants are located in Lusaka and the copperbelt where demand is highly concentrated (Ndiyoi & Mudenda, 2006). This sector also involves smallholder and individual large-scale farmers that are contracted to supply urban abattoirs. In most cases the established beef processors who own feedlots throughout the country buy animals from rural farmers at relative low prices, which they then put in feedlots before slaughtering. From the abattoir some beef finds its way to the independent butcheries or supermarkets. The costs of cutting and apportioning according to cuts as well as packaging are often borne by the retailers as there are no independent meat packers in Zambia.

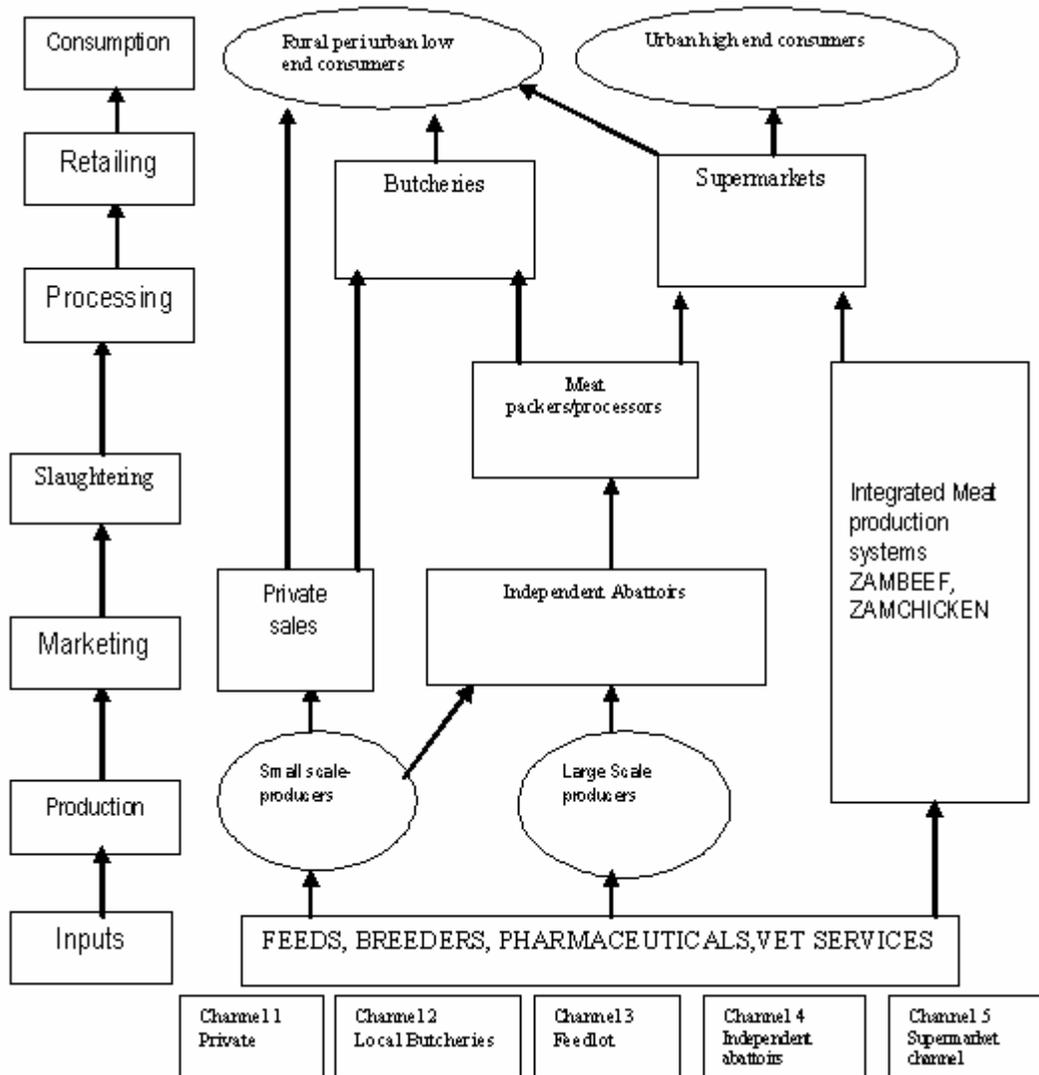
Individual traders dominate the beef value chain in the informal sector. According to legislation, beef should not be transported in a vehicle that is used to transport persons or other goods. Despite these restrictions, informal meat traders use pick-up trucks to transport up to five slaughtered cattle a day. In most cases the cattle are slaughtered at a communal slab but the meat is sold at the townships' fresh meat markets. The informal market channel provides an avenue for cattle not suitable for slaughter at an abattoir, and in these channels sick animals are sold without regard for veterinary controls. In addition to this, there is an emerging business pattern where informal meat traders rent cold room space from butchery owners to store meat from sick animals. Unfortunately, this occurs with the knowledge of the police, local authority and public health officials who run the township markets.

There are five major marketing channels for the cattle producers: livestock marketing agents, feedlots, abattoirs, butchers and private sales as illustrated in Figure 1.

- (i) Channel 1: Private buyers purchase first stage processed beef and prepare it for the supermarket and traditional butchery markets.
- (ii) Channel 2: Local butcheries sell directly to households especially in the rural and peri-urban areas.
- (iii) Channel 3: Large feedlots systems which are usually integrated from production through wholesaling to retail, such as Dar Farms.
- (iv) Channel 4: Independent abattoirs such as the ZAM ZAM model which concentrates on first and second stages processing before selling to the retailers.
- (v) Channel 5: Integrated chains with production, slaughtering and processing system supplying supermarkets. This model is used by Zambeef. The integration of operations encompasses production through to wholesaling of first stage processed meat.

The shortest, simplest and most popular option for small-scale farmers is to sell directly to the consumer. Livestock are bought for slaughter, investment or social functions such as weddings, funerals, customary and religious celebrations. Livestock play an important role in African societies. Private sales by the emerging sector are important as the farmer directly determines the price of the animals sold and does not incur any marketing costs. Demand in the private sales channel is, however, extremely irregular. Livestock marketing agents are facilitators bringing together buyers and sellers, without taking ownership, or actively assisting in the transfer of ownership, from the producer to the next buyer or customer. The agents organize live auctions on a regular basis. These agents function on a commission basis. Auctions are still a vitally important part and principal outlet for live animals.

Figure 1: The beef sector value chain.



There are three distinct stages along the processing chain. The first stage comprises the slaughtering of cattle and dressing of the meat to sides or quarters for wholesale. The second stage involves dressing meat to manageable sizes for the consumer, and the third stage is the processing of beef into ready-to-eat products. There are only seven large beef processing companies in Zambia, with Zambeef being the leader. Zambeef commands 48 per cent of urban beef sales plus a 24 per cent share of the national beef market. Other notable processors include Keembe Cold Storage, Pama meat and ZAM ZAM.

5.2 Determinants of smallholder farmers' participation in beef value chains

It is necessary to understand the major factors influencing smallholder beef farmers' access to modern beef marketing channels. A two stage econometric analysis was used to evaluate the determinants of their market channel choice. The first stage is a binary selection model followed by a second stage ordinary least squares (OLS) model. The first stage estimates the determinants of market channel choice whilst the second stage estimates the impact of market channel choice on input use, capital/labour ratio, return to capital inputs and labour inputs.

The first stage model is stated as:

$$(1) M_k = f(\text{Incentive, Risk, Farm Size}_{t-n}, \text{Other Assets}_{t-n}, \text{Policy Shifters, Other Shifters, IVs-M})$$

The second stage estimates the impact of the selected market channel choice (M_k) on the outcome of several variables such as input use, capital/labour ratio, return to capital inputs and labour inputs.

The second stage model is expressed as:

$$(2) Y = f(\text{Incentive, Risk, Farm Size}_{t-n}, \text{Other Assets}_{t-n}, \text{Policy Shifters, Other Shifters, } M_k)$$

Table 1 gives a description of the explanatory variables which were estimated using the model.

Table 1: Household characteristics

Variable	Unit	Type of variable
Region	Village or camp	Categorical
Age	Years	Continuous
Gender	Male or female	Dummy (0,1)
Education	Years in formal education	Continuous
Experience	Years in beef farming	Continuous
Training	Trained in agriculture production	Binary (0,1)
Access to market	Km from main road	Continuous
Extension	Access to marketing extension	Binary (0,1)
Herd size	Number of cattle owned	Continuous
Breed	Ownership of exotic cattle breed	Binary (0,1)
Household size	Number of family members	Continuous
Transport	Ownership of a pick up	Binary (0,1)
Equipment	Ownership of a knapsack	Binary (0,1)
Collective Action	Membership, cooperative	Binary (0,1)
Market	Distance from Zambeef	Continuous

The households interviewed during the survey were divided into two categories; traditional market channel farmers (TMCFs) and modern market channel farmers (MMCFs). The classification was based on the main market channel to which they supply their beef cattle. If a farmer supplies private abattoirs such as Zambeef he/she was assigned to be a MMCF. If they supply to local butcheries, informal traders or private sales he/she is assigned to be a TMCF. A comparative analysis of the key variables shows that the two groups are indifferent; for most of the key variables described in this section MMCFs seem to be better off than TMCFs. Revenue from beef, non-farm income, agricultural training, access to own transport and education level are exceptions as TMCFs are better off in these categories. Another major finding is that these two groups have similar trends with regards to most variables, except for revenue from beef, non-farm income, and distance from Zambeef whose difference between the two groups are significant. This supports the explanation on farmers' market strategy, which says that farmers do not have a discrete market channel choice.

Table 2: Characteristics of beef farmers in Namwala district⁴, 2007

	Description	Modern markets (n=83)	Traditional markets (n=31)	Overall (n=114)
Age	Average age of the household head	41.88	43.26	42.25
Education	Average years in formal educational training.	7.38	9.00	9.00
Gender	Percent male headed household heads	96.8	97.4	97
Experience	Average years in farming	18	15.	15
Arable land	Average hectares arable land	6.25	5.61	6.08
Herd size	Average number of cattle per respondent	55.81	51.00	54.50
Cattle breed	Percentage exotic cattle	60.2	51.6	57.9
Main road	Average distance from the main road	9.71	5.45	8.55
Access to	Average distance from Zambeef	24.10	13.50	20.67
Labour numbers	Average total labour numbers	9	8	9
Non-farm income	Average non agricultural income	K4,4 million	K16,2 million	K7,7 million
Access to transport	Percentage of farmers who have their own prick up truck	3.5	19	8
Access to equipment	Percentage of farmers who have their own knapsacks	65	67	65
Social capital	Percentage farmers who belongs to a cooperative	41	22	36
Agricultural training	Percentage of farmers who received formal agricultural training	16.9	35.5	21.9
Marketing extension	Percentage of farmers who have access to transport	77.1	64.5	77.3
Marketing strategy	Percentage of farmers selling to both formal and informal markets	55	78	65
Income from beef	Average total beef income in Kwachas	K4,5 million ⁵	K9,3 million	K5,8 million

According to the probit model results (Table 3) only distance from Zambeef as well as agricultural training are statistically significant at 5 and 10 per cent significance levels respectively. Agricultural training is negatively related to market channel choice. This

⁴ District in Southern province of Zambia where the household study was implemented.

⁵ 1USD=3500 Kwachas

means that farmers with more agricultural training are likely to participate in traditional beef market channels. Distance from Zambeef is positively related to market channel choice. This means that, on average, farmers marketing through Zambeef are further removed from their market destination than TMCFs. This does not make sense however; there is need for further in-depth analysis to explain why this is so. All other variables which were hypothesized to have an impact on smallholder farmers' market channel choice were not significant.

There are a number of possible explanations why the model choice was wrong. For instance there is not enough variation among the survey respondents. This means that, despite selling to different markets, they have similar characteristics and as a result there is not enough variation in the independent variable. Another explanation is that the presence of Zambeef has crowded out the informal sector; (local butcheries and private buyers) especially in the study area. Therefore most farmers have limited market alternatives outside Zambeef; which leads to skewed participation in modern markets compared to traditional market channels. Overall the model suggests that farmers in the study area do not have discrete market behaviour. This is supported by descriptive results which show that that 78 per cent of TMCFs and 55 per cent OF MMCFs sell their cattle to both the modern and traditional market channels. Therefore there is a need to refine the model to capture these shortcomings.

Table 3: Results of the Market channel choice model, 2007

Variables	Coefficient	Significance level(P>z)
Region	-0.03	0.71
Household size	0.07	0.19
Education level of the head	0.00	0.83
Gender of the household head	0.63	0.45
Age of the household head	0.00	0.77
Experience, years in farming	0.01	0.58
Use of extension	0.19	0.62
Non farm income (t-n) years	0.00	0.47
Land size in hectares	0.00	0.79
Transport in (t-n) years	0.51	0.37
Herd size	0.00	0.93
Cattle breed in (t-n) years	-0.07	0.74
Distance from the main road	0.01	0.67
Distance from Zambeef	0.02	0.03**
Received formal agricultural training	-0.63	0.08*
Cooperative membership	0.31	0.36
_cons	-16.02	0.55

***(P<0.01) 1 percent significance level **(P<0.05) 5percent significance level *(P<0.01) 10percent significance level

5.3 Impact of market channel choice

In the second level of a two stage model beef income, capital to land ratio and capital to labour ratio were used to determine the impact of market channel choice on income and input use. According to the results (Table 3), market channel choice has no impact on beef revenue and input use indices. In terms of beef revenues; household size, gender of household head, use of extension services, herd size and distance from Zambeef are statistically significant at a 10 per cent significance level. For capital to labour ratio, household size, farming experience, herd size, distance from Zambeef and agricultural training are significant. In terms of the capital to land ratio; access to extension services, herd size and distance from Zambeef are significant.

The conclusion from the second stage model is that market channel choice is not important in determining income and input use. This may suggest that market channel choices are not important factors in livestock production among smallholder farmers in Zambia, although there is a need for further analysis to ascertain these results. The results of the second stage model supports the findings of the first stage model in that smallholder farmers do not have a defined market channel choice pattern, thus the beef market is not a significant determinant of smallholder cattle production (Table 4 overleaf).

Table 4: Results of impact of market channel choice, 2007

	Beef income(n=114)		Capital to Land ratio(n=114)		Capital to Labour ratio (n=114)	
	Coefficient.	P>t	Coefficient	P>t	Coefficient	P>t
Region	-1208.22	0.96	-315098.70	0.29	-290877.10	0.45
Household size	-66099.35	0.00	319729.90	0.14	23071.78	0.05
Education	151.72	0.98	25516.14	0.74	51653.82	0.32
Gender	490406.30	0.02	2857826.00	0.24	-4566053.00	0.87
Age	3609.34	0.28	-17621.84	0.65	-122232.20	0.48
Experience	-586.41	0.90	53186.51	0.34	-436464.60	0.00
Extension	-366951.20	0.00	2911232.00	0.05	-2413383.00	0.77
Land size	1009.28	0.76	-21351.44	0.58	-29676.50	0.36
Pickup truck	118424.10	0.53	-851444.40	0.70	7349335.00	0.55
Herd size	2998.05	0.00	-39617.32	0.00	42163.92	0.10
Knapsack	154672.70	0.23	-1565988.00	0.30	5254061.00	0.64
Cattle breed	-93224.56	0.15	512950.70	0.50	2084163.00	0.29
Main road	1082.10	0.79	-8643.95	0.85	-21189.14	-0.21
Zambeef	-3287.59	0.10	45206.65	0.06	-56685.75	0.09
Training	-136747.80	0.24	1030147.00	0.44	-6019704.00	0.00
Cooperative Member	-39186.07	0.71	36748.84	0.98	-3569309.00	0.35
Market choice	95164.08	0.42	-1768089.00	0.20	-4245403.00	0.46
Constant	2088566.00	0.83	-109000000.	0.33	862000000.	0.00

**($P < 0.01$) 1 percent significance level **($P < 0.05$) 5percent significance level *($P < 0.01$) 10percent significance level

6 Conclusion

The study assessed the effects and impacts of restructured/modern and traditional beef marketing channels on smallholder beef farmers in the Namwala district of the Southern province of Zambia. Specifically, the study examined the smallholder beef farmers' participation in both of these marketing channels and the effects of each of these beef marketing channels on beef farmers' herd growth. The majority (77 per cent) of the respondents sell their beef cattle to modern marketing channels, with 23 per cent still selling their cattle through the traditional marketing channels.

The study findings nullifies most of hypotheses set in the beginning of this paper. The only hypothesis which is not nullified is hypothesis 1 (there are weak supply relationships between smallholder beef producers and the formal agribusiness supply channels). However household characteristics (except for the distance from Zambeef and the main road) and collectives are not a significant influence on small-scale beef producers' market channel choice.

Lastly market channel choice has significant impact on income from cattle as well as technology use. The general conclusion is that farmers do not have a discrete marketing strategy and they are still participating in both market regimes (traditional and modern).

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Regoverning Markets

Regoverning Markets is a multi-partner collaborative research programme analysing the growing concentration in the processing and retail sectors of national and regional agrifood systems and its impacts on rural livelihoods and communities in middle- and low-income countries. The aim of the programme is to provide strategic advice and guidance to the public sector, agrifood chain actors, civil society organizations and development agencies on approaches that can anticipate and manage the impacts of the dynamic changes in local and regional markets. The programme is funded by the UK Department for International Development (DFID), the International Development Research Centre (IDRC), ICCO, Cordaid, the Canadian International Development Agency (CIDA), and the US Agency for International Development (USAID).

Agrifood Sector Studies

These studies look at specific agrifood sectors within a country or region. Research studies have been carried out in China, India, Indonesia, Mexico, South Africa, Turkey, Poland and Zambia covering the horticulture, dairy and meat sectors. Part A describes the observed market restructuring along the chains. Part B explores the determinants of small-scale farmer inclusion in emerging modern markets. Using quantitative survey techniques, they explore the impacts on marketing choices of farmers, and implications for rural development.

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