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The determinants of the performance of dairy smallholders in Malawi

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Abstract

Milk production in Malawi is stagnating although neighbouring countries steadily increase outputs. In this paper, we explored the determinants of the performance of dairy smallholders. As indicators of on-farm performance we used annual milk yield, calving intervals, and annual dairy income. Regression models revealed that milk yield was negatively related with farmer's age, female farmer, and household size, but positively influenced by farmers' experience. Calving intervals were strongly associated with labour costs and breeding method. Income from dairying was only associated with farmers' education but varied strongly with region. Regional effects existed for all performance indicators which may partly be rooted in land scarcity in the south and the efforts of development agencies to promote dairying in the northern and central regions. Results also revealed a tendency for pure breeds to produce higher outputs, but crossbreeds due to lower costs provided better income. Thus, we recommend that experienced farmers become involved in extension programs to provide comprehensive services that help farmers make more efficient use of their scarce assets, and thus realise more of the animals' genetic potential with regard to the three observed performance indicators.

Keywords: dairy production, performance, milk yield, calving intervals, dairy income

1 Introduction

Dairy production in developing countries improves the diet of consumers and the income and livelihood of smallholders (McDermott *et al.*, 2010; Banda *et al.*, 2012). Sedentary smallholders produce almost 80 % of the milk in southeastern Africa (Phiri *et al.*, 2010). According to the International Farm Comparison Network (IFCN), from 2010 to 2014 the annual milk production in Tanzania increased by 23 % to 2.0 million tons, in Kenya by 10 % to 4.3 million tons, and in Uganda by 52 % to 1.8 million tons, but in Malawi outputs remained constant at 0.05 million tons (Hemme, 2015). These developments show that dairying constitutes a growing segment in agricultural production in Sub-Saharan countries, but that development of the dairy sector involves major challenges as the figures for Malawi suggest.

Key on-farm constraints include land and fodder scarcity (Moffat & Austin, 2003; Kawonga *et al.*, 2012), animal health problems (Tebug *et al.*, 2011; Banda *et al.*, 2012; Tebug *et al.*, 2012b), poor infrastructural endowment, in particular cow housing systems (Banda *et al.*, 2012), breeding strategies (Chagunda *et al.*, 2004, 2015), and limited management skills (Chagunda *et al.*, 2006; Tebug *et al.*, 2012a). We therefore suggested that the development of the dairy value chain is best advanced by increasing on-farm performance (Baur *et al.*, 2016). However, despite the efforts of governmental and

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non-governmental organisations to improve farm performance (Duteurtre & Atteyeh, 2000; USAID, 2012), no study exists that identifies determinants of economic on-farm performance in Malawi. This paper aims at filling this gap by identifying the factors that determine on farm performance with regards to milk yield, calving intervals, and dairy income. Based on the observed determinants, we identify avenues for farmers and extension services to improve on farm-performance of smallholder dairy farmers in Malawi.

2 Methods

2.1 Data collection

Data were collected by survey during June and July 2013 (Banda *et al.*, 2016). The survey was performed in Malawi's three major milk-producing regions, Blantyre (South), Lilongwe (center), and Mzuzu (North). The study involved 12 research assistants responsible for data collection and entry. Data collection was jointly administered by the Ministry of Agriculture and Food Security, the Department of Agricultural Research Services, and Lilongwe University of Agriculture and Natural Resources. Before the data collection process started, the survey was pretested, and the interviewers received training on how to complete the English questionnaire.

The sample was drawn from a population consisting of farmers from 15 milk bulking groups (MBGs), equally distributed across the three study regions. Memberships in the MBGs differed substantially, with largest numbers appearing in the South. After collection of the questionnaires, the field supervisor checked each questionnaire for errors. Nevertheless, the dataset included inconsistencies, in particular with regard to the dependent variables milk yield and calving intervals. Implausible information led to exclusion in many cases and finally to the reduced sample size used in this study. As displayed in Table 1, 540 surveys were collected from farmers, with a majority of 54 % of the farmers located in the southern region of Blantyre, followed by 27 % of the farmers from the central region of Lilongwe, and 19 % of the farmers living in northern region of Mzuzu (Banda *et al.*, 2016).

Due to missing or implausible information we excluded more than half of the cases, and finally worked with a sample of 251 farmers. The reason for the exclusion of cases was missing information for the three lactation phases upon which we calculated milk outputs. We excluded cases when the calculation of average annual milk yield exceeded 7000 litres. Furthermore, we excluded cases with regards to calving intervals if the farmer couldn't clearly indicate when the cow last calved. Finally, we excluded outliers with regards to dairy income. When farmers realised, according to our calculations, more than 1,000,000 Malawi Kwacha (MWK) per cow, the figures for cost items were not deemed to be realistic and the case was excluded. As a consequence, the regional distribution changed, with the northern region being slightly overrepresented at the cost of the southern region (Table1).

Table 1: *Sample description: the actual regional distribution of farmers, the study sample and the considered cases.*

	Blantyre (South)	*Lilongwe (centre)*	*Mzuzu (North)*	*Total*
Dairy cows in the region *	22,870 76 %	2,708 9 %	4,514 15 %	30,092 100 %
Farmers (1,000)	1,167 63 %	475 26 %	215 12 %	1,857 100 %
Study sample	292 54 %	146 27 %	102 19 %	540
Cases considered	131 52 %	61 24 %	59 24 %	251

* Source: Chagunda *et al.* (2010)

2.2 Calculating the dependent variables

The study investigated three indicators of performance, namely, annual milk yield, calving intervals, and annual dairy income. Milk yield was measured as average output per day for three lactation phases. Because annual yields also depend on time in lactation, annual yields were calculated by splitting the total lactation phase into three periods, namely, first until 60th day, 61st until 150th day, and 151st day until the end of the lactation phase. For each period, the number of days is represented by p_i. In addition, for each period, the average yield (y_i) per day and cow together with calving interval (c) allowed us to calculate annual milk yield per cow (Q) as follows (Equation 1):

$$Q = 365 * \sum_{i=1}^{3} \frac{p_i * y_i}{c} \tag{1}$$

Calving interval was estimated based on rough indication of calving frequencies and detailed figures for lactation length. Calving frequency was indicated in years (every year, every second year, etc.) whereas lactation length was indicated in days. Hence, if lactation length was longer than 365 days and the farmer indicated that the cow calved every year, we estimated calving intervals based on lactation length plus an assumed dry period of 60 days.

The third dependent variable, dairy income (DI_i), was calculated for each farm separately from the total annual milk production (Q_i) multiplied by annual average price (P_i) minus direct costs (DC_i) such as costs of concentrates, by-products, veterinarian care, artificial insemination, salt, and depreciation costs (Equation 2).

$$DI_i = Q_i * P_i - DC_i \quad (2)$$

An overview and description of dependent variables used in the regression models is given in Table 2. Mean annual milk yield per cow was almost 2,400 litres, with calving intervals of almost 500 days and a mean income from dairy production above MWK 140,000. As expected, the three variables were all significantly correlated. The strongest correlation existed between milk yield and dairy income with $r = 0.81$, $p < 0.001$, and there were negative correlations between calving interval and annual milk yield with $r = -0.47$, $p < 0.001$ and between calving interval and annual dairy income with $r = -0.36$, $p < 0.001$.

2.3 Model specification

Table 3 lists the independent variables included in the model. Considering demographic factors, the farmers in the sample had an average age of around 50 years, with the majority being female farmers (55 %). Farmers had on average 7 years of experience, and households consisted on average of 5.5 people. According to Tebug *et al.* (2011), farmers' milk yield in Malawi is positively associated with education and experience in dairying. In addition, the southern region Blantyre served as a reference category for a dummy variable for regional effects. We controlled for regional conditions such as temperature, rainfall, or the effect of development projects aiming at promoting the dairy sector regionally (USAID, 2012).

All farmers in the sample owned one dairy cow. Overall, two thirds of the cows were exotic breeds – predominantly Holstein Friesians, and one third of the animals were crosses with local zebus. The regional distribution of the breeds was unbalanced. In Blantyre the crossbreeds (52 %) and pure breeds (48 %) were about equal, while in Lilongwe and Mzuzu pure breeds dominated over crossbreeds with 90 % and 86 % respectively.

The milk price was considered as an explanatory variable as it is an incentive for dairy farmers to use more inputs (e.g. concentrates) which would result in an increase of milk yield per cow. Amiani (2011) shows a positive impact of milk price on milk yield for the Bungoma district in Kenya. Furthermore, we assumed that pure exotic breeds allow for higher yields than crossbreeds (Banda *et al.*, 2012) and included breed type as a dummy. For all the various cost items, we expected positive effects on yield except for veterinary costs.
Among the cost items, by-products accounted for the highest costs followed by concentrates (mostly soya) and costs for veterinary services.

Concerning determinants of calving intervals, the literature suggests that costs that directly relate to reproduction, such as artificial insemination, increase with calving intervals, and that artificial insemination results in longer calving intervals than natural mating (Banda *et al.*, 2012). Accordingly, we controlled for the effects of breeding methods when specifying the ordinary least squares (OLS) model for calving intervals. With regard to the models explaining dairy income, the literature does not offer any farm-level analysis; we therefore specified models using similar variables as for calving intervals, except for the various cost positions that could not be included as they were used to calculate the dependent variable.

For the statistical analysis, we distinguished three models for each indicator: all breeds, only crossbreeds, and only exotic breeds. This approach allowed us to consider the breed types as different breeding methods. In addition, for the models explaining milk yield, we present a version with disaggregated cost items. For the models explaining calving intervals for subsamples distinguished by breeds, we could not consider the independent variables housing type and health programs because the cases were reduced below acceptable numbers. For the models explaining dairy income, we could not include the direct costs and the respective items as the inclusion would have violated endogeneity assumptions.

We estimated OLS models with robust standard errors to deal with heteroscedasticity (Verardi & Croux, 2008). To test for the quality of the model specification, we performed a link test (Pregibon, 1980) and the Ramsey regression specification-error test (Ramsey, 1969) for omitted variables in order to check for goodness of fit. Furthermore, we applied the Chow-test (Chow, 1960) to models with the subsamples defined by breed type to check if parameters differed. The analysis was performed using the software package StataSE 12.

Table 2: *Descriptive Statistics for the three dependent variables indicating performance in the study.*

Description	*Number*	*Mean*	*SD*	*Min.*	*Max.*
Annual milk yield per cow (in litres)	251	2,394	1,256	283	6,622
Calving intervals (days)	230	493	182	365	1,095
Annual income from dairy farming (MWK)†	251	141,429 †	141,089	–151,286	778,378

† Malawi Kwacha (MWK) 141,429 ~ USD 410 at time the study was conducted.

Table 3: *Descriptive statistics of independent variables.*

Variable	*Description*	*N*	*Mean*	*SD*	*Min.*	*Max.*
Age	Age of respondent in years	243	50.5	13.2	20	83
Gender	Binary variable: Value 1 for male farmer. Otherwise 0	251	0.45	0.50		
Education (primary)	Dummy variable: Value 1 if farmer attained primary education. Otherwise 0	166	0.64	0.45		
Education (secondary and higher)	Dummy variable: Value 1 if farmer attained secondary or higher education. Otherwise 0	56	0.21	0.41		
Experience	Years of experience in dairy farming	250	6.83	5.07	1	40
Household size	Number of people belonging to the same household	251	5.57	2.04	1	10
Grassland	Share of area used for pasture cultivation	251	0.16	0.29	0	1
Dummy Lilongwe	Dummy Variable: Value 1 if region is Lilongwe. Otherwise 0	251	0.24	0.43		
Dummy Mzuzu	Dummy Variable: Value 1 if region is Mzuzu. Otherwise 0	251	0.24	0.42		
Milk price	Milk price (MWK†/litre)	251	101	18.3	56.5	200
Dummy breed	Dummy Variable: Value 1 if the breed is a crossbreed. Otherwise 0	251	0.33	0.51		
Labour costs	Annual labour costs for dairying (MWK†)	251	87,702	25,939	12,684	116,800
Direct costs	Expenditures total (MWK†)	251	97,481	70,909	0	404,900
Concentrates	Expenditures for feed concentrates (MWK†)	251	25,547	42,683	0	167,000
By-products	Expenditures for by-products (MWK†)	251	52,196	45,498	0	255,000
Veterinarian care	Expenditures for veterinarian service (MWK†)	251	9,217	11,399	0	62,000
Artificial insemination	Expenditures for artificial insemination (MWK†)	251	3,012	3,512	0	35,000
Salt	Expenditures for salt (MWK†)	251	4,937	7,907	0	72,000
Other	Other expenditures (MWK†)	251	2,571	12,246	0	120,00
Dummy breeding: Artificial insemination	The cow is fertilised with artificial insemination	251	0.41	0.49		
Dummy breeding: Natural mating	The cow is fertilised by natural mating	251	0.23	0.42		
Dummy breeding: Artificial insemination & natural mating	The cow is fertilised using both artificial insemination and natural mating	251	0.09	0.29		
Dummy housing type 1: Open kraal	The cow is kept in a very basic barn	251	0.14	0.34		
Dummy housing type 2: Closed kraal	The cow is kept in a barn with a roof	251	0.36	0.48		
Dummy housing type 3: Modern kraal	The cow is kept in a barn with a roof and solid ground floor	251	0.24	0.43		

† Malawi Kwacha (MWK) 1000 ~ USD 2.90. min and max. not reported for dummies.

3 Results

3.1 Determinants of milk yield

Results from OLS regression for the full sample as well as for the two breed types are presented in Table 4. Between 25 % and 40 % of the variance could be explained. Accordingly, age of the farmer had a negative effect on yields, and male farmers achieved significantly higher outputs than female farmers. Larger household size negatively affected milk yield, potentially caused by reduced resource availability in terms of capital and land that could be allocated to dairying. Region also had an influence as farmers in Lilongwe achieved significantly higher outputs than farmers in Blantyre, who served as the reference category. Surprisingly, the milk price had a negative effect on milk output. This might be related to differences within the three main regions.

Considering the subsamples for breeds, regional effects were more pronounced for exotic breeds than crossbreeds. Exotic breeds achieved much higher yields in Lilongwe and Mzuzu than in Blantyre. For crossbreeds, labour costs had a positive effect on milk yield, whereas the yield of exotic breeds increased only marginally with labour investments, suggesting that output from crossbreeds was much more sensitive to labour inputs than output from exotic breeds.

3.2 Determinants of calving interval

Calving intervals in the full sample were slightly negatively associated with grassland, suggesting that the farmers who dedicated more of their land to grassland and roughage production provided better feeding rations resulting in better reproductive performance. Elderly farmers also had longer calving intervals, when considering the complete sample. In Mzuzu, calving intervals were significantly longer than in the reference category Blantyre. Furthermore, crossbreeds had shorter calving intervals than exotic breeds. Also natural mating resulted in significantly longer calving intervals compared against artificial insemination which served as the reference category.

As displayed in Table 5, the analysis also revealed that artificial insemination was a more efficient reproduction method than natural mating. In the sample for crossbreeds, experience of the farmer also helped to reduce calving intervals.

3.3 Determinants of dairy income

Considering determinants of dairy income (Table 6), demographic effects were small whereas regional effects persisted. Accordingly, the farmers in Lilongwe and Mzuzu achieved higher incomes than the farmers in Blantyre.

Considering the sample for holders of crossbreeds, we found that education had a weakly positive effect upon dairy income, suggesting that higher education improved efficiency in the use of inputs but only for the smaller sample of crossbreeds and not for the larger sample of exotic breeds.

4 Discussion

We analysed three indicators and their respective determinates of the performance of smallholders engaging in dairying for three regions in Malawi. The performance indicators were milk yield, calving intervals, and dairy income. Results revealed an annual average milk yield of 2,394 litres per cow, which equals 6.5 litres per day. The yields observed in this study are thus similar to the yields reported for Malawi by Tebug *et al.* (2011) (5 to 8 litres) but lower than those stated by USAID (2012) (9 to 11 litres). Calving intervals were 493 days, with crossbreeds (377 days) having shorter calving intervals than exotic breeds (499 days). These figures deviate from figures reported elsewhere, with crossbreeds having calving intervals of 382 days (Banda, 1996) and pure exotic breeds having calving intervals of 396 days (USAID, 2012). The annual income from dairy products was estimated at MWK 141,400 which equals USD 210 at the time the study was conducted.

The regression analysis revealed demographic factors such as age, gender, experience, and household size to be major determinants of milk yield. Age and gender effects may result from low adoption rates of innovations for elderly farmers and women (Tebug *et al.*, 2012a). In addition, the lower performance of female than male farmers could be related to other aspects such as lower assets. Furthermore, education had a positive, but non-significant effect upon milk yield as observed also by Tebug *et al.* (2012b). The finding that education and experience were positively associated with milk yield shows that management skills of farmers play an important role for the improvement in milk yields.

Regarding calving intervals, we found the share of land allocated to grassland and roughage production to positively impact on fertility as it reduced calving intervals. Furthermore, we found that crossbreeds have shorter calving intervals then pure exotics which points to the better adaptation traits of crossbreds to climatic conditions. Results also suggest that natural mating is less efficient than artificial insemination which may be rooted in farmers' decisions to first apply artificial in-

Table 4: *Ordinary least square estimates for explaining milk yield.*

Specification	*(1) All breeds, direct costs aggregated*	*(2) All breeds, direct costs disaggregated*	*(3) Crossbreeds, direct costs disaggregated*	*(4) Exotic breeds, direct costs disaggregated*
Age	–11.95 **	–12.24 **	–6.43	–8.88
	(–5.52)	(–5.72)	(–11.03)	(–6.84)
Gender	344.97 **	354.96 **	630.92 ***	266.91
	(–154.71)	(–155.8)	(–295.08)	(–191.33)
Education (primary)	276.99	265.15	519.33	117.52
	(–222.87)	(–224.77)	(–455.34)	(–279.7)
Education (secondary & higher)	303.00	278.10	93.44	411.96
	(–258.67)	(–262.83)	(–510.03)	(–349.22)
Experience	27.62 *	27.20	26.18	32.41
	(–14.16)	(–14.5)	(–24.9)	(–15.84)
Household size	–75.03 **	–76.12 **	–135.01 ***	–32.13
	(–33.35)	(–34.19)	(–61.07)	(–40.15)
Grassland	218.07	231.96	441.19	361.16
	(–323.17)	(–323.49)	(–496.18)	(–393.83)
Dummy Lilongwe	1479.18 ***	1491.38 ***	108.30	1637.78 ***
	(–244.48)	(–253.15)	(–620.33)	(–268.29)
Dummy Mzuzu	255.21	245.06	–244.87	498.47 ***
	(–175.34)	(–178.04)	(–424.4)	(–207.05)
Milk price	–7.66 **	–8.16 **	–5.14	–11.88
	(–3.67)	(–3.83)	(–4.80)	(–5.32)
Dummy breed	–186.35	–178.62		
	(–157.90)	(–164.10)		
Labour cost (000)	4.74	4.62	10.25	1.75
	(2.84)	(2.88)	(4.61)	(3.82)
Feed (000)		0.18		
		(0.98)		
Vetcare (000)		0.74		
		(0.98)		
AI (000)		–9.52		
		(16.19)		
Salt (000)		8.54		
		(7.28)		
Other (000)		0.67		
		(2.62)		
Direct costs (000)	0.44		–0.94	0.55
	(0.83)		(2.17)	(0.99)
Constant	2703.71 ***	2799.26 ***	1930.22 ***	2879.65 ***
	–494.18	–516.28	–848.40	–653.81
N	233	233	77	156
R^2	0.34	0.35	0.25	0.41

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: *Ordinary least square estimates for explaining calving intervals.*

Specification	*(1) All breeds, direct costs aggregated*	*(2) All breeds, direct costs disaggregated*	*(3) Crossbreeds, direct costs disaggregated*	*(4) Exotic breeds, direct costs disaggregated*
Age	1.75 *	1.83	1.79	1.21
	(–0.97)	(–1.24)	(–1.91)	(–1.17)
Gender	–10.17	–53.51	10.19	–16.41
	(–25.53)	(–33.47)	(–41.21)	(–33.31)
Education (primary)	–68.29	–19.46	–129.27 *	–45.28
	(–52.51)	(–59.69)	(–139.56)	(–60.21)
Education (secondary and higher)	–28.80	42.78	–76.35	–26.83
	(–57.85)	(–67.7)	(–154.71)	(–67.25)
Experience	–0.76	2.23	–6.20	0.68
	(–2.64)	(–2.98)	(–5.23)	(–3.32)
Household size	0.43	–0.21	3.59	–2.13
	(–6.35)	(–7.74)	(–13.78)	(–7.26)
Grassland	–82.00 *	–98.92	–129.72	–66.70
	(–42.62)	(–74.08)	(–75.31)	(–51.97)
Dummy Lilongwe	26.77	52.97	144.90	15.01
	(–38.16)	(–51.08)	(–89.76)	(–42.47)
Dummy Mzuzu	63.64 *	100.12 **	127.76	47.85
	(–35.79)	(–47.42)	(–115.15)	(–38.66)
Milk price	–17.59	11.23		
	(–29.73)	(–40.58)		
Dummy breed	–0.01 **	–0.01 *		
	(0.00)	(0.00)		
Labour cost	–1.27	–1.40	–1.12	–1.23
	(0.57)	(0.73)	(1.36)	(0.62)
Dummy breed method (Natural mating)		126.11 ***		
		(–37.84)		
Dummy breed method (AI & Natural mating)		–6.29		
		(–46.13)		
Dummy Housing type (Closed Kraal)		–34.19		
		(–39.98)		
Dummy Housing type (Modern Kral)		32.12		
		(–41.47)		
Health program	30.72	30.00	67.63	30.01
	(–30.33)	(–44.79)	(–61.74)	(–36.29)
Constant	569.33 ***	464.21 ***	559.68 ***	588.46 ***
	(–91.95)	(–126.29)	(–221.19)	–102.36
N	213	151	61	152
R^2	0.129	0.230	0.295	0.082

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6: *Ordinary least square estimates for explaining dairy income in Malawi Kwacha (measured in thousands).*

Specification	*(1) All breeds*	*(2) Crossbreeds*	*(3) Exotic breeds*
Age	–0.93	–0.29	–0.86
	(–0.65)	(–1.17)	(–0.82)
Gender	4.31	35.74	–9.12
	(–17.38)	(–33.05)	(–21.77)
Education (primary)	22.3	90.02 *	–13.16
	(–25.91)	(–48.59)	(–32.71)
Education (secondary and higher)	28.02	101.15 *	–0.96
	(–30.94)	(–57.18)	(–40.15)
Experience	–0.36	–0.36	–0.06
	(–1.44)	(–3.13)	(–1.55)
Household size	–5.12	–12.30 *	–2.18
	(–3.85)	(–6.59)	(–4.7)
Grassland	–3.48	5.12	11.38
	(–39.42)	(–60.86)	(–49.4)
Dummy Lilongwe	159.88	34.87	179.47
	(–26.27)	(–85.56)	(–27.83)
Dummy Mzuzu	75.54	5.81	101.64
	(–19.73)	(–37.05)	(–22.74)
Dummy breed	11.23		
	(–18.1)		
Constant	128.51	84.97	125.80
Experience	(–45.42)	(–77.26)	(–59.00)
N	233	77	156
R^2	0.22	0.115	0.287

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

semination and then switch to natural mating in case of repeated failures. Concerning dairy income, we found a slightly significant and positive effect between income and education for the subsample of crossbreeds. It is however unclear while this effect exists only in crossbreeds.

Furthermore, we found regional effects across all three performance indicators which finally result in significant variance in incomes in the three regions. In Lilongwe and Mzuzu, dairy income was significantly higher than in Blantyre, which served as the reference category. However, the regional effects may result from different causes: Whereas farmers in Lilongwe achieved significantly higher yields compared with the reference category (farmers in Blantyre), the farmers in Mzuzu had longer calving intervals pointing to problems with the fertility of their cows. Accordingly, regional effects are rooted in different causes: In the South it is mostly the unfavourable conditions for dairy production including demographic pressure, very limited access to pastureland, and the long distances to be covered to gather forage. Furthermore, there are more farmers in the South with fewer extension workers per farmer compared to the northern and central regions. But unfortunately, this study could not quantify the benefits streaming from interaction with extension workers. In addition, the central and northern regions potentially enjoyed more and longer support from aid agencies than the southern region. Projects such as Land O'Lakes targeted central and northern regions, explaining why exotic breeds dominate in these regions with 90 % in Lilongwe and 86 % in Mzuzu, while in Blantyre only 50 % of the animals were exotics. Furthermore, the presence of development agencies also explains why milk yields in central and northern regions with an average of 3,507 litres in Lilongwe and 2,140 litres for Mzuzu, are higher as in Blantyre with 1,989 litres.

5 Conclusion

Performance on smallholder dairy farms in Malawi is largely determined by demographic variables, such as age, gender, education, and experience, but also varies with region. We showed that education and experience contribute positively to milk yield while advanced age had a negative effect. The reversing effects of age and experience shows that farmers in the sample are rather new to the business, and do not necessarily engage for lifetime in dairying since older farmers are not necessarily more experienced. Accordingly, educated, experienced farmers should be leading in extension programs to pass on their management knowledge to less experienced farmers. Finally, the regional effects — farmers in Blantyre (southern region) are clearly less efficient than the farmers in Lilongwe (centre) and Mzuzu (northern region) — may result partly from land scarcity and associated lower feeding ratios offered in the South and to some degree from the longer presence of development agencies in the northern and central regions. As regards the stagnation of milk production in Malawi, we can conclude that the ongoing gain of experience will have a beneficial impact, and that support for smallholders is essential when they start milk production. But equally important avenues to improve on-farm performance are investments in education, self-administered cross breeding programs, and improved roughage production.

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