

Economic evaluation of beef cattle production systems in China

Wendy Gong[1], KA Parton[2], ZY Zhou[3], and RJ Cox[2]

[1] The University of Sydney, Faculty of Rural Management, Orange NSW 2800 Australia

[2] Charles Sturt University, Faculty of Science and Agriculture, Orange NSW 2800 Australia

[3] James Cook University, Townsville Queensland 4811 Australia

wgong@csu.edu.au

Contents

Introduction
Materials and methods
Results and discussion from household farmers
Results of feedlots
Conclusions ad implications
References
Appendix

Abstract. The livestock industry in China has undergone massive changes since the liberalisation of markets started in 1985. The beef sector is no exception to this transition with production and consumption increasing faster than all other meats in the last two decades. The number of cattle has nearly doubled since 1980 to be around 141.6 million in 2005 and beef production has increased at a much faster rate than the cattle inventory.

As the third largest beef producing country in the world, China exports and imports beef cattle. The emerging Chinese market has generally been seen as an opportunity for the Australian red meat industry. However, given the rate of increase in output, China may also provide a threat. With this in mind, understanding the current beef cattle industry situation in China is of great importance.

The central objective of this paper is to evaluate the economic returns on China's beef cattle operations and to analyse their implications for beef cattle industry development. In this paper, three beef cattle production systems are compared and examined across three geographical regions. Statistical methods are employed to evaluate these production practices. The results reveal the shifting balance between demand and supply in China and shed light on China's trade behaviour. Possible opportunities for Australian beef industry participants to explore the Chinese market are also discussed.

Keywords: Cattle industry, opportunities or threats, China, Australia.

Introduction

The livestock production industry in China is of importance to Australia for three reasons. First, Australia is one of the world's leading producers of cattle and was the world's second largest exporter of beef after Brazil in 2004/05. Australia currently exports over 65 per cent of its total beef production. Second, China has been seen both as a potential importer country for Australia and a potential competitor, because China both imports premium beef for higher demands and exports beef to Asian countries and Middle East countries. Third, with the world's fastest growing economy, there are an increasing number of investment opportunities and market opportunities in China. Therefore, understanding how China's cattle production industry works and what are the main factors determining profitability is of great importance for the Australia cattle industry.

Beef cattle production is a large and important segment of the Chinese agricultural industry (Jiang *et al*. 2003, p.3; Longworth *et al*. 2001, p.2). China had 141.6 million cattle (including buffalo) in 2005 and is the third largest beef production country, with an output of 7.12 million tonnes of beef in 2005 (MoA 2006). Production varies from year to year depending on local conditions and seasons, and especially on feeding systems. Evaluation of productivity in terms of total output from the herd and total input into the herd has seldom been empirically investigated. Most studies concentrate on feed efficiency (Chen *et al*. 1996; Ward *et al*. 1986; Zhou *et al.* 2001) and stress the herd output without regard to feed period and herd size (Liu *et al*. 2004; Zhang 2002, pp.39-41).

For beef cattle producers to maintain profitability, they must continue to seek methods of increasing efficiency and reducing the cost of production. Three beef cattle production systems were analysed, and factors that influenced costs, revenues and margins were identified. These three cattle production systems were household breeder, household feeder and feedlot, systems. The objective of this study was to evaluate factors that affect cattle farm performance and production costs, such as the initial weight when purchased, pen size, feed period and feed efficiency.

Material and methods

The data consisted of 10,323 cattle that were placed on feed between January and

December 2004 by 151 respondents, who were surveyed in the Inner Mongolia Autonomous region, Anhui province and Shandong province. The following information was extracted from the survey questionnaires: purchase price, initial weight when purchased, raising period (months on feed), sale price and weight, feed costs, the number of cattle sold, cost per period, margin and margin per period. Other costs such as vaccination fee, artificial insemination fee, trading cost and labour cost were also obtained.

To compare differences among China's cattle production regions, three regions were selected. Shandong and Anhui provinces were identified as typical agricultural areas, and Inner Mongolia was identified for as a typical pastoral area.

Two types of cattle production practices are adopted by household farmers and these formed the basis for two groups in the survey. Group A consisted of farmers who buy, grow and sell cattle (system A); while those in Group B breed, grow and sell cattle (system B). For further comparison, a third group consisted of feedlot production systems.

Feed cost was measured in yuan per head. Feedstuffs include hay, straw and the by-products of harvested grain. It should be noted that for household farmers, only mixed and concentrated feed was taken into account as purchased feed costs. The raising period was measured in actual months.

With regard to feedlot performance, the feed conversion ratio was measured using a four–grade numeric percentage: 1= 1.0, 2= between 1.1 and 2.0, 3= 2.1 and 3.0, 4= more than 3.1. Depreciation cost, vaccination and medicine costs, artificial insemination fee, trading cost, water and electricity cost and transportation cost were measured in yuan per head.

To differentiate between households and feedlot cattle production systems, margins were calculated differently. For household systems, the margin was defined as:

(1) M = SP * SW- FC - PP * IW - TC - VF – AIF.

For feedlot systems, the margin was defined as:

(2) M = SP* SW - FC - PP * IW - LC - VMC - TC - WEC- DC

where: M = Margin;

SP = Sale price;

SW = Sale weight;

FC = Feed costs;

PP = Purchase price;

IW = Initial weight;

TC = Trading cost;

VF = Vaccination fee;

AIF = Artificial insemination fee;

LC = Labour cost;

VMC =Vaccination & medicine costs;

TC = Transportation cost;

WEC = Water & electricity costs;

DC = Depreciation cost.

Analysis of variance (ANOVA) was employed to test fro differences across the three regions, followed by an independent samples test for two production systems in each region. Then linear and multiple regressions were carried out to find the factors which affect the margin. The statistical software SPSS was used for the analysis.

Results and discussion

System A, household cow-calf producers, was analysed first in the three regions. Then differences between this and system B, in which farmers breed, grow and sell their cattle, were identified. Feedlots were then examined in a similar manner.

Results from Household Farmers in System A

Sixty-three farmers in the survey had adopted system A. As shown in Table 1, farmers in Inner Mongolia had lower cattle purchasing costs but higher purchase weights than those of Shandong and Anhui. The ANOVA statistical test results showed that the cattle sale weight, months on feed, margin and margin per period did not vary much across the three regions.

Calves had the highest purchase price of 9.28 yuan/kg in Anhui, followed by Shandong (8.08 yuan/kg) and Inner Mongolia (7.50 yuan/kg). These differences were significant at $P<0.001$. This suggests that competitive calf purchase prices are found in Inner Mongolia. This may be due to the more favorable environment for grazing on pasture.

Weight when purchased followed a different trend to the purchase price: cattle in Inner Mongolia were heaviest at 259.4kg, followed by Shandong at 201.7kg and Anhui at 174.2kg. Again, the P value of 0.021 suggested that purchase price is significantly different among the three regions.

Feed costs presented a similar picture to that of purchase price. Farmers in Anhui paid the highest price for feed, on average 971.41 yuan per head, with 840.39 yuan paid in Shandong and 511.88 yuan paid in Inner Mongolia. Again these are statistically significant differences. The reason for this lies in the fact that cattle in Inner Mongolia have easier access to grass as a feed resource than those in the agricultural areas. This reduces the overall need for purchased feed. Moreover, in the two agricultural areas, the

cost of feed was similar. The differences in feed costs also result from the different lengths of feeding period.

There is a similar outcome when comparing cattle sale price and sale weight across the three regions. Cattle were sold at the highest price and heaviest weight in Anhui, with 8.21 yuan/kg and 369.1kg, with 8.08 yuan/kg and 360.0kg in Shandong, and 7.62 yuan/kg and 362.5kg in Inner Mongolia. While cattle sale weight was not significantly different, the cattle sale price was significantly different (P=0.041). It can be seen that cattle sale price was lower in Inner Mongolia than that in the other two regions, though they have similar sale weights.

The average raising period ranged from 7.5 months in Inner Mongolia to 10.7 months in Shandong, with 9.3 months in Anhui. These differences are not significant.

The number of cattle sold per household varied significantly (P=0.001) in the three regions. Inner Mongolia had the greatest number of cattle sold at 4.8 head, followed by 3.9 head in Anhui and 1.9 head in Shandong. With constraints of farm land size and natural resources, cattle herd sizes in Inner Mongolia were larger than those in the other two regions.

There was not much difference in vaccination fee, artificial insemination fee and trading cost among the three regions. This suggested that the animal health treatment technology was similar.

Two further points deserve mention. First, most of the calves, perhaps 80%, are crossbred either with local premium breeds or exotic breeds. Second, there was about a 70-80% success rate of pregnancy with artificial insemination. With improved technology, a higher success rate will reduce the cost of cattle reproduction.

Cattle farmers in Anhui seemed a little more profitable than those in the other two regions (Shandong and Inner Mongolia) when calculating operating margin (495.22 yuan, 469.22 yuan, and 389.06 yuan, respectively). However, statistical analysis showed that this variable was not significant (P=0.214). There was also no statistical difference in margin per period. As for cost per period, there were significant differences: Inner Mongolia (43.59) showed a competitive advantage over the other two regions (Anhui 81.23 and Shandong 71.72).

As noted in the beef cattle expenses in Figure 1, feed costs account for just over one-third of the gross costs, so cost saving may be achieved in the area of feed costs. Since pastures present a low cost source of feed relative to conserved feeds, calving in pastoral areas can significantly reduce the feed costs for beef cattle. Calf purchasing costs provided the largest share (65.63%) of production costs which then become the significant factor influencing number of cattle herds in production.

Based on a correlation matrix, variables that seemed to influence the margin were selected for inclusion into a multiple regression analysis . Among these variables, five were identified as significant factors: raising period, sale weight and price, feed costs and purchasing weight. As can be seen in Table 2, sale weight (0.820) and sale price (0.304) were positively associated with margin per period, which means that higher sale weight and higher price would result in more profit. However purchasing weight (-0.690) and feed costs (-0.375) had a negatively association, suggesting that they may disadvantage profit. The independent variable of raising period was fit in a quadratic curve with margin per period. The statistical results showed that these five variables can explain the data quite well (R^2= 0.767), and the model was significant with an F value of 30.72.

Results from Cattle Household Farmers of System B

Forty-four farmers engaged in breeding, growing and selling cattle were interviewed. The costs of raising cows are not counted[1], but the revenue from selling calves was marked as profit. The percentage of farmers engaged in the cow-calf production was obtained from the question “where do you source cattle for raising?” This varied in the different provinces, but there were about 41% of farmers on average engaged in breeding. No purchase price or initial weights were available for this group of farmers.

As shown in Table 3, farmers in Inner Mongolia[2] incurred the largest expense on feeds with 1012.3 yuan, followed by that in Anhui (864.7 yuan) and Shandong (618.5 yuan). These differences are partly explained by cattle being kept longer in Inner Mongolia for 24 months, while they were kept for only 11.1 months and 9.4 months in Anhui and Shandong. Accordingly, there were higher weight gains (358.3 kg) in Inner Mongolia than those in Anhui (162.7 kg) and Shandong (156.9 kg). However, the statistical tests (Table 3) showed that these differences in feed costs were not significant among these regions (p =0.09).

[1] It is the custom of beef cattle household farmers not to calculate the costs of keeping the cow. However, for the study, they can be estimated at about 700 *yuan*/cow annually.

[2] Only three respondents are included in this category. This may affect the accuracy of data on the stocker group in Inner Mongolia.

Cattle were sold at the lowest price of 6.60 yuan/kg in Inner Mongolia. This contrasted with higher prices in both Shandong (9.86 yuan/kg) and Anhui (9.12 yuan/kg). There are two main reasons for this. First, selling two-year old cattle gives a lower price than a 6-12 month calf; second, as a remote, pastoral region, transportation facilities from Inner Mongolia are still not developed, and farmers receive discounted sale prices. From the test of the variables of margin/period and cost /period, this will be seen more clearly.

The cost per period varied considerably across the three regions. Farmers spent the most in Anhui at 81.72 yuan for one head of cattle per month, with about 71.72 yuan in Shandong and only 43.59 yuan in Inner Mongolia. However, in Inner Mongolia, farmers had the largest margin of 1328.33 yuan, compared with 772.54 yuan in Anhui and 899.85 yuan in Shandong. When feeding time was considered, farmers in Shandong had the highest margin/month of 110.69 yuan, followed by Anhui with 86.05 yuan and Inner Mongolia at 56.19 yuan (though these were not significant differences).

To summarise, there were lower feed costs in Inner Mongolia than in Anhui and Shandong. Cattle were kept longer in Inner Mongolia for about 20-26 months with a higher sale weight. In the agricultural areas of Anhui and Shandong, calves were sold at a younger age (9.4 -11.1 months) but with higher feed costs. Moreover, to maximize monthly profit, the length of the raising period and the final weight were the most important factors to be taken into account.

Results from Comparisons of Cattle Household Farmers of System A and System B

To compare the differences between cattle cow-calf farmers and stockers, the method applied was to test whether the situations were similar in these two groups in each region.

As shown in the results of the Independent–Samples t test in Table 4 for Inner Mongolia, calves were sold at similar weights, despite having different feed costs, raising periods, sale prices and costs per period. Also, farmers received a similar margin per animal raised in a month. As the costs of keeping cows were not calculated in system B, the advantage of this system (shown in Table 4) is probably over-estimated. There will be a comparative shortage of calves in the market of Inner Mongolia if system B is unprofitable.

In Anhui Province (Table 5), total feed costs ($P=0.283$) were about same for both cattle production practices, but after a similar raising time, cost and margin per animal, per month varied drastically (with $P<0.001$ and $P=0.007$, respectively). Different cattle production practices are the reason for the great differences in cost and margin per animal, per month. Calf-cow production had a higher profit than that of stockers; but without considering the costs of keeping cows.

A similar situation occurred in Shandong Province (Table 6). Only raising period and cattle sale number had no significant differences in the two production practices: the other variables were highly significant (such as margin per animal, per period ($P=0.002$) and cost per animal, per period ($P<0.001$)). Farmers engaged in calf-cow practice seemed more profitable than stockers.

Results of Feedlots

Forty-four feedlots [3] were surveyed with 10,072 head of cattle raised in feedlots. In this practice, the producer usually purchases store cattle and feeds them until achieving the market weight. Table 7 indicates the gross costs and revenues per head of cattle among the three regions. The similarities and differences of these regions evaluated in this study are presented below.

Using ANOVA (see Table 7), the key differences between the regions were revealed to be calf purchase prices, number of cattle sold and sale price. With respect to calf purchase price, the situation is similar to that for household cattle farmers, with farmers in Anhui paying the highest calf purchasing price (9.13 yuan/kg), followed by those in Shandong (8.05 yuan/kg) and those in Inner Mongolia (7.74 yuan/kg). However, calves were bought at a similar weight of about 271.7 kg on average, which suggested that calves were above one-year old. The feed costs did not vary much among the three regions at about 945.67 yuan per head, with similar a feeding period (7.9 months). Feed conversion rate showed the same level among the three regions at 2.5 on average. The similarity in these variables suggests that feedlot farmers have adopted a similar feeding technology.

It is interesting to see that fed cattle[4] were sold at different prices even though they had similar sale weights. Fed cattle could be sold for the highest prices in Anhui at 8.64 yuan/kg, then in Shandong at 8.28 yuan/kg

[3] Feedlots are a group of pens, or barn lot, where steers and heifers are fattened for slaughter. In this study, pen sizes of more than 11 cattle which were specialised in fattening for slaughter were classified as feedlots.

[4] Fed cattle refer to steers or heifers fattened and ready for slaughter.

and in Inner Mongolia at 7.69 yuan/kg. There was also high correlations between calf purchase prices and fed cattle sold prices (Pearson Correlation=0.625). This is logical with both calf prices and fattened cattle prices reflecting proximity to higher price consumer markets.

The feedlot margin was not affected by location (P=0.423). The average gross profit reported was 546.46 yuan on average. Among locations, Anhui tended to be the most profitable and was followed by Shandong and Inner Mongolia (568.53, 565.54 and 510.26, respectively). Similar findings were reported by Liu *et al*. (2004) who found that the average profit for feedlots in 2003 was 432.71 yuan per head and there had been a decreasing trend of profit since 2001.

When months on feed were considered, the margin efficiency, namely margin per period, was calculated. Margin efficiency was greatest for Shandong (77.27) followed by Inner Mongalia (71.80) and Anhui (67.34). These results agree with those reported by Wu and Liu (2003), who found that the monthly profit per head in feedlots was 50-80 yuan.

The feedlot size can be described in terms of the number of cattle sold, which varied from 3 to 3200 head and was subject to the local natural resources, labour cost, market demand, and so on. Inner Mongolia had the largest average herd size of 575 head, while Anhui had 47.9 head and Shandong had 11.7 head. Though herd size did not affect individual cattle margin, it was correlated with other costs such as transportation cost (Pearson Correlation=0.405). This can be interpreted as greater herd size and greater efforts in management and transportation to deliver the cattle to market in Inner Mongolia.

As seen from Figure 2, calf purchasing cost had the largest share of 64.11% of total cost, followed by feed costs (26.85%), labour cost (3.29%) and transportation cost (1.72%). Water & electricity costs and vaccination & medicine costs combined to about 2%. This is supported by Liu *et al*. (2004), who found that the cost of purchasing calves and feed were the greatest two in total production costs.

As co-linearity existed among the variables, a single regression was used to demonstrate the contributing factors for margin and margin/period. Using a quadratic function, margin was regressed on raising period (P=0.013, R=0.191). As shown in Figure 3, margin increased until it reached the highest point at 10 months, then decreased as the time period lengthened. The equation can be displayed as:

$$\text{Margin} = -181.78 + 166.43\,RM - 8.45\,RM^2,$$

Where: RM = Raising months.

The reason for this is because within a certain time, the profit brought by cattle weight gain is larger than production cost, while after the turning point, keeping cattle will cause marginal losses with a lower weight gain for similar additional feed expenditure.

It should be kept in mind that the reasons for farmers to trade their cattle are complicated not only by suitable economic timing of cost and profit, but also for other reasons such as market price, individual-financial situation, expectation of future price trends and available market arrangements[5].

With regard to the factors affecting margin per period, cost per period was identified as important. A single regression showed that a quadratic curve[6] (Figure 4) was the best fit for margin/period and cost/period (R=0.209, P=0.009). This reveals that as more expenditure was incurred on feedlots, more profit would accrue until a turning point (margin/period = 95), after which the profit still increased but at a lower growth rate as the cost increased. The indication is that more expenditure on average might be appropriate, as the average margin per month was around 72.

Conclusions and implications

Based on the results of this research, the following conclusions and implications can be drawn for the Chinese beef-cattle operations examined.

1. The feedlot system achieves the highest gross return for beef-cattle operations in China. It is a widely adopted practice among beef operations evaluated in this study. The second most profitable system is fattening store cattle and selling at about 364kg. The least competitive is the cow-calf system and selling calves at about 9 - 11 months of age.

2. Household cattle systems are similar in the two agricultural regions, namely Anhui and Shandong. However, feed costs in Inner Mongolia showed a competitive advantage, given that pasture is one of the cheapest feeds. Longer feeding periods lead to a higher price of buying and selling cattle in Inner Mongolia.

3. Feedlot profitability is similar in the three surveyed regions. Similar feed conversion ratios show that farmers have the same level of feeding technology. To save feed costs,

[5] A detailed analysis of transaction costs causing market behaviour is described in a related paper by Gong *et al*. 2006.

[6] The equation can be written as: $Y = 36.02 + 0.27X - 0.002X^2$. Here Y stands for margin per period; X stands for cost per period.

most of the feedlots surveyed have their own distilleries that have as a by–product protein feed for cattle.

4. Retaining calves to a later marketing stage can bring more returns to household farmers; however that was not quite true for feedlots, because profit will decrease after a certain period of time. This shows the importance of marketing time on profitability.

5. Calf expenditure is the largest proportion of total costs for both household farmers and feedlots, about two-thirds of the total cost. For household farmers, an investment of a calf[7] at about 1755 yuan is not easy, given their low yearly income; notwithstanding the clear benefit of expanding the scale of cattle beef production. The same goes for feedlots. Thus financial shortages will probably constrain the development of the cattle beef industry.

6. The gross margin shown in the analysis was over-estimated for cow-calf production operations as the cost of the cows was not included. If this cost is calculated, the margin will be very low and may even be negative. For example, with a cost of about 700 yuan/head in Anhui, the margin would be about 72 yuan/head, not 772 yuan/head as shown in Table 3. This was confirmed when we interviewed farmers. They expressed the view that there was low profit in keeping cows in a cow-calf operation. The less incentive to keep cows, the less the number of calves produced. Eventually, the number of fed cattle will decrease. A supportive policy may be needed to encourage cow-calf farmers.

7. With the trend of decreasing numbers of cows, there may be slower growth ahead for cattle inventories and beef production in China. A re-structure of the beef cattle industry will emerge based on market forces. Small-scale and unspecialised operations will be taken over by more specialised cattle raising systems.

8. Improved profitability and cattle performance in feedlots has been gradually adopted in China. Many foreign companies have invested in cattle feedlots in China and Australia may also seize these opportunities with its technical and management expertise. Furthermore, Chinese local governments are always keen to encourage investment in feedlots to expand the livestock sector in their area. As a result, foreign investors are in a good position to negotiate favourable concessions such as taxes, fees and leases.

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[7] This figure was calculated from Table 1 as an average level.

Appendix

Table 1. Cattle herd characteristics by household farmers – system A

	Units	Inner Mongolia	Anhui	Shandong	Sig.	Total sample
Purchase price	*Yuan*/Kg	7.50	9.28	8.08	<.001	8.29
Weight when purchase	Kg	259.4	174.2	201.7	.021	211.7
Feed costs	*Yuan*/head	511.9	971.4	840.4	<.001	854.83
Vaccination fee	*Yuan*/head	3.0	3.0	3.0		3.0
Artificial Insemination fee	*Yuan*/head	15	15	15		15
Trading cost	*Yuan*/head	8	8	8		8
Raising months	Months	7.5	9.3	10.7	.076	9.15
Sale number	Head	4.8	3.9	1.9	.001	3.10
Sale price	*Yuan*/Kg	7.62	8.21	8.08	.041	8.01
Sale weight	Kg	362.5	369.1	360.0	.877	364.2
Cost/period	*Yuan*/head, month	567.18	296.96	292.09	.012	329.11
Margin	*Yuan*/head	389.06	495.27	469.22	.214	470.20
Margin/period	*Yuan*/head, month	60.76	56.59	50.67	.420	54.49

System A: Farmers buy, grow and sell cattle.

* There are 63 respondents considered as household cattle farmers with herd number less than 10.

** Margin is calculated from the formula: M = SP * SW- FC - PP * IW - TC - VF – AIF; where M = Margin; SP = Sale price; SW = Sale eight; FC = Feed costs; PP = Purchase price; IW = Initial weight; TC = Trading cost; VF = Vaccination fee; AIF = Artificial insemination fee

Table 2 Model Summary of A Multiple Regression[a]

	B	Std. Error	t	Sig.
Constant	-5.935	27.114	-0.219	0.828
Raising period	-10.851	1.749	-6.205	0.000
Sale weight	0.274	0.062	4.381	0.000
(Raising period)^2	0.319	0.074	4.328	0.000
Purchasing weight	-0.192	0.054	-3.583	0.001
Sale price	11.318	3.591	3.152	0.003
Feed costs	-0.026	0.010	-2.594	0.012

R^2 = 0.767, Std Error of the Estimate = 11.074, F = 30.72, Sig. <0.001.

Figure 1. Composition of gross costs of household cattle farmers

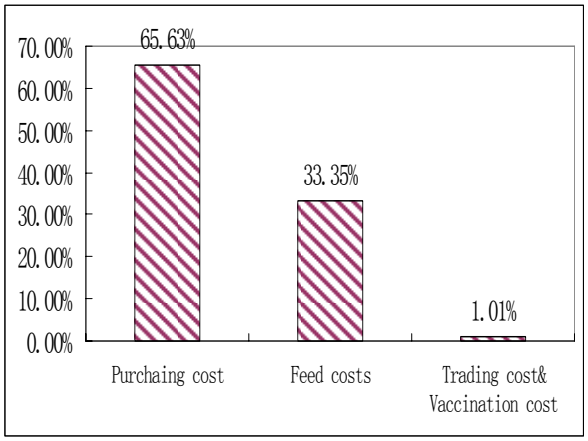

Figure 2 Composition of costs of feedlots

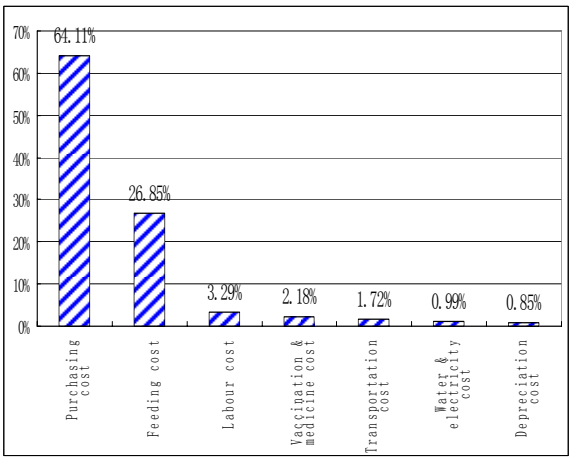

Figure 3 Relationship between margin and raising time

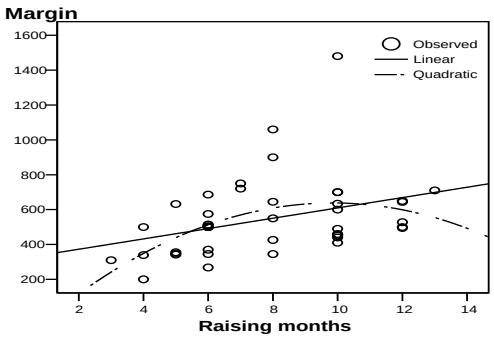

Figure 4 Relationship between Margin per Period and Cost per Period

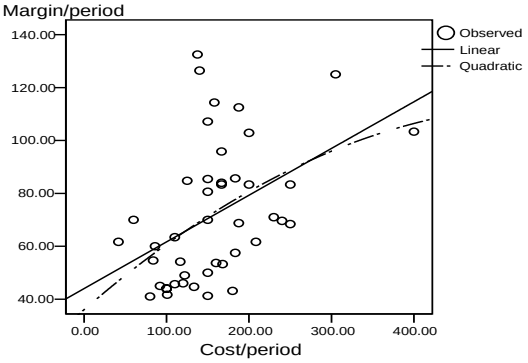

Table 3. Cattle herd characteristics by household farmers – system B

	Units	Inner Mongolia	Anhui	Shandong	Sig.	Total sample
Purchase price	*Yuan*/Kg					
Weight when purchase	Kg					
Feed costs	*Yuan*/head	1012.3	864.7	618.5	0.092	802.0
Vaccination fee	*Yuan*/head	3.0	3.0	3.0		3.0
Artificial Insemination fee	*Yuan*/head					
Trading cost	*Yuan*/head	8	8	8		8
Raising months	Months	24.0	11.1	9.4	<0.001	14.5
Sale number	Head	3.7	1.0	1.2	<0.001	1.3
Sale price	*Yuan*/Kg	6.60	9.86	9.12	<0.001	9.42
Sale weight	Kg	358.3	162.7	156.9	<0.001	174.3
Cost/period	*Yuan*/head, month	43.59	81.23	71.72	0.022	75.85
Margin	*Yuan*/head	1328.33	772.54	899.85	0.010	848.05
Margin/period	*Yuan*/head, month	56.19	86.05	110.69	0.263	91.29

System B: Farmers breed, grow and sell cattle.

* There are 44 respondents considered as household cattle farmers with herd number less than 10.

** Margin is calculated from the formula: M = SP * SW- FC - PP * IW - TC - VF – AIF; where M = Margin; SP = Sale price; SW = Sale eight; FC = Feed costs; PP = Purchase price; IW = Initial weight; TC = Trading cost; VF = Vaccination fee; AIF = Artificial insemination fee.

Table 4. Independent samples test for Inner Mongolia

		A	B	Sig.
Purchase price	*Yuan*/Kg	7.50		
Weight when purchase	Kg	259.4		
Feed costs	*Yuan*/head	511.9	1012.3	0.002
Vaccination fee	*Yuan*/head	3.0	3.0	
Artificial Insemination fee	*Yuan*/head	15		
Trading cost	*Yuan*/head	8	8	
Raising Months	Months	7.5	24.0	0.002
Sales number	Head	4.8	3.7	
Sale price	*Yuan*/Kg	7.62	6.60	0.009
Sale weight	Kg	362.5	358.3	0.860
Cost/period	*Yuan*/head, month	567.18	43.59	0.012
Margin	*Yuan*/head	389.06	1328.33	<0.001
Margin/period	*Yuan*/head, month	60.76	56.19	0.731

Table 5 Independent Samples Test for Anhui Province

		A	B	Sig.
Purchase price	*Yuan*/Kg	9.28		
Weight when purchase	Kg	174.2		
Feed costs	*Yuan*/head	971.4	864.7	0.283
Vaccination fee	*Yuan*/head	3.0	3.0	
Artificial Insemination fee	*Yuan*/head	15		
Trading cost	*Yuan*/head	8	8	
Raising Months	Months	9.3	11.1	0.074
Sales number	Head	3.9	1.0	<0.001
Sale price	*Yuan*/Kg	8.21	9.86	<0.001
Sale weight	Kg	369.1	162.7	<0.001
Cost/period	*Yuan*/head, month	296.96	81.23	<0.001
Margin	*Yuan*/head	495.27	772.54	<0.001
Margin/period	*Yuan*/head, month	56.59	86.05	0.007

Table 6 Independent Samples Test for Shandong Province

		A	B	Sig.
Purchase price	Yuan/Kg	8.08		
Weight when purchase	Kg	201.7		
Feed costs	Yuan/head	840.4	618.5	0.025
Vaccination fee	Yuan/head	3.0	3.0	
Artificial Insemination fee	Yuan/head	15		
Trading cost	Yuan/head	8	8	
Raising Months	Months	10.7	9.4	0.290
Sales number	Head	1.9	1.2	0.178
Sale price	Yuan/Kg	8.08	9.12	<0.001
Sale weight	Kg	360.0	156.9	0.002
Cost/period	Yuan/head, month	292.09	71.72	<0.001
Margin	Yuan/head	469.22	899.85	0.001
Margin/period	Yuan/head, month	50.67	110.69	0.014

Table 7 Cattle herd characteristics and ANOA by feedlot

	Units	Inner Mongolia	Anhui	Shandong	Sig.
Purchase price	Yuan/Kg	7.74	9.13	8.05	0.020
Weight when purchase	Kg	277.5	267.0	270.0	0.948
Feed costs		870.63	955.5	1026.69	0.334
Labour cost	Yuan/head	110	118.67	120	
Vaccination & medicine cost	Yuan/head	30	30	30	
Transportation cost	Yuan/head	70	60	50	
Water & electricity cost	Yuan/head	35	35	35	
Depreciation cost	Yuan/head	90	59.5	80	
Feed Conversion ratio	4-grade	2.4	2.5	2.6	
Raising Months	months	6.7	8.9	8.2	0.611
Sales	Head	575.1	48.3	12.0	0.009
Sale price	Yuan/Kg	7.69	8.64	8.28	0.045
Sale weight	Kg	486.5	479.0	470.0	0.919
Cost/period	Yuan/head, month	172.81	135.44	165.63	0.256
Margin	Yuan/head	510.26	568.53	565.54	0.722
Margin/period	Yuan/head, month	71.80	67.34	77.27	0.610