Analysis on the cost-benefit change and its influencing factors of pig breeding in Heilongjiang Province

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Abstract

The cost-benefit of pig breeding and its influencing factors are related to the development of pig breeding industry. The author mainly uses the decomposition analysis method to calculate the cost-benefit of pig breeding in Heilongjiang Province and its contribution to the influencing factors. The results showed that: compared with the national average levelfrom 2007 to 2018, the competitive advantage of scale benefit of pig breeding in Heilongjiang Province decreased significantly, the growth space of pig breeding benefit in Heilongjiang Province was narrowed, and the cost increased significantly. The price played a very important role in the growth of benefit and cost of pig breeding in Heilongjiang Province. In the future, we need to take the connotative growth path to promote the benefit growth of Heilongjiang pig breeding, while stabilizing the pig price, it is important to improve the efficiency of pig farms above the scale and reducing the cost of pig breeding.

Key Words: Benefit analysis. Cost analysis. Pig breeding.

1. Introduction

Central Document No. 1 in 2020 emphasized that stabilizing the effective supply of live pigs has always been a key task of China's agricultural and rural work. It calls for the full implementation of the provincial overall responsibility system and the mayor responsibility

system of "vegetable basket", and the implementation of policies and measures to support pig production, so as to accelerate the resumption of pig production.

In recent years, Heilongjiang provincial Party committee and government have taken a series of measures to promote the development of pig industry, which has played an important role in stabilizing the supply of pork market in Heilongjiang Province and even the whole country. However, with the changes of pig breeding scale and pork price, the cost-effectiveness of pig breeding in Heilongjiang Province has also changed significantly.

In order to avoid losses, the farms reduced pig production, and some small scattered farmers withdrew from the breeding industry. In particular, with the influence of African swine fever and other factors, the supply of pig market has been drastically reduced, which has severely affected the people's dining table and aroused the government's high concern. The pig industry in Heilongjiang Province has great development potential.

How to improve the efficiency of pig breeding in Heilongjiang Province and jump out of the low development period of double decline in quantity and benefits is a key problem faced by the high-quality development of pig breeding industry in Heilongjiang Province. The development of pig breeding industry is directly related to the development of regional agriculture and the increase of farmers' income. It also plays an important role in stabilizing the supply of pork market in China.

2. literature Review

There are abundant research results on the cost-benefit of pigs at home and abroad, mainly focusing on the development of pig industry (charlebois, 2014; Liu Gang et al., 2018; Zhang Lixiang, Luo Qianfeng, Han Leigao, 2020; Gao haixiu, Wang Mingli, etc., 2020; Liu Chenyang, Wang Jimin, etc., 2021) and the cost-benefit of pig breeding (Schaffer et al., 2003; Zhang Wenbo, 2016).

Charlebois et al.(2014) believed that the overall change trend of the U.S. pig industry is that the scale of breeding has stabilized and the number of pig farms has gradually decreased, indicating that the U.S. pig industry is highly concentrated and the degree of intensification, standardization and scale has continued to improve, which is conducive to the sustainable development of the U.S. pig industry.

Zhang Lixiang, Luo Qianfeng, Han Leigao (2020) believed that the key factors for the sustainable development of China's pig industry are the integration of the scale of pig farming, the stabilization of pork prices, and the strengthening of epidemic prevention and

control.

Gao Haixiu, Wang Mingli, etc.(2020) believed that healthy pig breeding methods combined with technological innovation can improve the competitiveness of China's pig industry.

Liu Chenyang, Wang Jimin, etc. (2021) believed that to enhance the international competitiveness of China's pig industry, achieve high-quality development of China's pig industry, and promote the sustainable development of the pig industry.

Liu Gang et al. (2018) believed that the pig breed project can promote the upgrading of breeding methods, which is conducive to improving technological innovation and promoting the development of the pig industry.

Schaffer et al. (2003) proposed that the breeding cost of family traditional free range pig breeding is higher than that of large-scale pig farms.

Liu Jurun (2020) believed that the economic benefits of pig breeding are related to the practical interests of breeding units and directly affect the sound development of the social economy.

Zhang Renzhi (2021) believed that the large-scale operation of pigs can reduce the cost of pig breeding and improve the technical level, which is conducive to disease prevention and control, and thus improves the economic benefits of pig breeding.

To sum up, most of the research results of domestic and foreign scholars have conducted theoretical analysis from the aspects of pig industry development, farmers' income, breeding cost and benefit, but there are few results of empirical analysis on the cost-benefit of different pig breeding scale in China. Therefore, This paper studies the cost-benefit and its influencing factors of pig breeding in Heilongjiang Province and analyzes the cost-benefit, which can provide decision-making reference for the government to formulate supporting policies for pig breeding industry.

3. Analysis Method and Data Description

The increase of benefit of pig breeding and decrease of cost are the comprehensive reflection of production and management indexes such as farmers' breeding ability, feeding management level and pig breeds. The higher the level of benefit and the lower the cost of pig breeding, it reflects the higher the level of output obtained by the farmer’s unit input. This is the core goal pursued by professional breeding and the key to the development of the pig breeding industry. The factor decomposition method can be used to identify the changes of

cost-benefit and the effect of the quantity and price of each factor on the benefit and cost of pig breeding in Heilongjiang Province and China. The specific formula is:

$$\Delta R = \Delta\pi/\pi = (\pi_t - \pi_0)/\pi_t \quad (1)$$

In formula 1, $\Delta\pi$ represents the increase of pig breeding income, π_t represents the pig breeding income in the T phase, π_0 represents the pig breeding income in the base period, and 0 and t represent the pig breeding comparison period. The pig breeding income in formula 1 is calculated by pig breeding price V and pig breeding yield y, that is:

$$\pi = vy \quad (2)$$

Further considering the changes of the period, and substitute formula 2 into formula 1 to obtain,

$$\Delta R = [(v_0 + \Delta v)(y_0 + \Delta y) - 1]/v_0 y_0 \quad (3)$$

After sorting out formula 3, it can be concluded that:

$$\Delta R = \Delta v/v_0 + \Delta y/y_0 + \Delta v\Delta y/v_0 y_0 \quad (4)$$

In the formula, ΔR represents the rate of change in the income of pig breeding, v and y represent the price and meat yield of pigs respectively, Δv and Δy represent the changes in pig price and meat yield respectively; 0 represents the base period of pig breeding.

In formula 4, $\Delta v/v_0$ represents the proportion of the impact of price changes on the growth of pig breeding benefits during this period, $\Delta y/y_0$ represents the proportion of the impact of changes in pork production during this period on the growth of pig breeding benefits, and $\Delta v\Delta y/v_0 y_0$ represents the proportion of the interaction between changes in pork production and price during this period on the growth of pig breeding benefits. Therefore, we can further calculate the pig breeding price, yield and their cross impact contribution rate，that is:

$$R_v = (\Delta v/v_0)/\Delta R \quad (5)$$

$$R_y = (\Delta y/y_0)/\Delta R \quad (6)$$

$$R_{vp} = (\Delta v\Delta y/v_0 y_0)/\Delta R \quad (7)$$

In recent years, the rising cost of pig breeding has become the most critical factor affecting the cost-benefit change of pig, and the cost of pig breeding is also one of the core factors of pig breeding benefit. In this paper, the price and quantity decomposition formulas are constructed to reflect the impact of price and quantity changes on the cost of pig breeding. Among them, the individual price index is used to reflect the influence degree and result of individual cost item price and its consumption on unit production cost. The cost result formula of individual factors is as follows:

$$p_1q_1 - p_0q_0 = (1/2)[(p_1q_0 - p_0q_0) + (p_1q_1 - p_0q_1)] + (1/2)[(p_0q_1 - p_0q_0) + (p_1q_1 - p_1q_0)] \quad (8)$$

In formula 8, p and q respectively represent the price of each input factor and the input quantity in pig breeding, and 1 and 0 represent the research comparison period and base period respectively.

On the basis of single factor, the decomposition formula of total production cost can be further integrated:

$$\sum p_1q_1 - \sum p_0q_0 = (1/2)[(\sum p_1q_0 - \sum p_0q_0) + (\sum p_1q_1 - \sum p_0q_1)] + (1/2)[(\sum p_0q_1 - \sum p_0q_0) + (\sum p_1q_1 - \sum p_1q_0)] \quad (9)$$

The first two items in formula 8 and formula 9 reflect the cost change share of comprehensive cost and single factor cost under the condition that the number of input elements remains unchanged, while the cost change share of comprehensive cost and single factor cost reflected by the latter two items under the condition of constant element price. Furthermore, the contribution rate of each factor to the total cost increment can be reflected by the proportion of price share and output share in the total share.

The cost-benefit data used in this paper mainly comes from the cost-benefit data of pig breeding in Heilongjiang Province and the whole country in different scales from 2007 to 2018 in the National Agricultural Product Cost-benefit Data Compilation. In order to ensure the comparability of the sample data, the cost-benefit data were technically processed according to the standard breeding days, converted into 4 months (120 days) breeding cycle for comprehensive decomposition analysis.

4. Analysis on Income Fluctuation and Influencing Factors of Pig Breeding

4.1. Analysis on the changing trend of pig breeding income in Heilongjiang Province

The income change of pig breeding directly determines the operation status of pig farmers. According to the analysis of the characteristics of pig breeding change trend in Heilongjiang Province, there are two main points: first, the benefit of pig breeding in Heilongjiang Province is similar to that of the whole country, which is slightly increased, but lower than the national average level; secondly, the benefit of pig breeding in Heilongjiang Province has obvious characteristics of fluctuation trend.

Table 1 shows the average income of pig breeding head of different scales in Heilongjiang Province and the average income of pig breeding nationwide from 2007 to 2018. Compared with the national average, the pig breeding income of Heilongjiang Province in this

period was lower than the national average level, except that the pig breeding income of free-range was slightly higher than the national average level.

Table 1: Average income of pig breeding heads of different scales yuan/per pig

Year	China				Heilongjiang Province			
	Free -range	Small -scale	Medium -sized	Large -scale	Free -range	Small -scale	Medium -sized	Large -scale
2007	1007.6	1119.3	1185.4	1254.4	1232.4	1213.8	1116.5	1126.6
2008	1086.9	1309.4	1338.0	1409.5	1203.9	1286.9	1266.8	1286.1
2009	917.4	1031.9	1035.3	1110.5	1087.6	1102.0	1080.6	1081.6
2010	990.0	1071.5	1113.5	1173.6	994.6	1050.8	1026.3	1059.5
2011	1437.3	1571.2	1621.2	1721.8	1478.9	1525.8	1563.2	1520.2
2012	1275.8	1388.4	1445.3	1506.5	1330.9	1421.8	1425.9	1440.0
2013	1266.8	1385.3	1435.7	1495.3	1315.1	1429.1	1375.2	1393.8
2014	1161.1	1249.3	1296.3	1348.0	1171.7	1215.9	1224.6	1191.9
2015	1364.2	1456.1	1507.3	1547.8	1334.3	1393.1	1426.3	1420.4
2016	1632.2	1749.0	1800.4	1884.7	1590.5	1650.7	1686.1	1683.8
2017	1326.2	1423.7	1472.0	1552.8	1331.5	1360.9	1361.8	1372.6
2018	1170.7	1213.3	1269.1	1331.1	1016.5	1031.3	1041.1	1068.3

Note: The data is calculated based on the data in National Agricultural Product Cost-benefit Data Compilation (2008-2019).

The average annual income of free-range pig breeding is 38 yuan each pig, which is higher than the national average; the average annual income of small-scale pig breeding is 24 yuan each, lower than the national average; the average annual income of medium-scale pig breeding is 77 yuan each; and the average annual income of large-scale pig breeding is 141 yuan each, lower than the national average. Moreover, the incomes of free-range pigs, small-scale pigs, medium-sized pigs and large-scale pigs in Heilongjiang province are close to each other, with an average annual variation rate of only 3%.

The results showed that, in addition to the scale of free-range pig breeding, the benefit level of single pig breeding in Heilongjiang Province was significantly lower, and the pig breeding efficiency of different scales had the significant characteristics of homogeneous competition. Improving the efficiency of scale pig breeding is the focus of promoting the stable development of the pig industry in Heilongjiang Province. Secondly, from the change trend of pig breeding income in Heilongjiang Province, the pig breeding benefit has obvious fluctuation characteristics with the same trend, and basically consistent with the fluctuation trend of the whole country. This characteristic shows that the benefit of pig breeding in Heilongjiang Province is greatly affected by the national market, and the homogeneous

competition is relatively prominent.

On average, pig breeding in Heilongjiang Province presents a relatively large fluctuation cycle in 4-5 years. The instability of breeding efficiency seriously affects the stable development of pig industry. The low efficiency of pig breeding in Heilongjiang Province and the prominent problem of homogeneous competition also restrict farmers to expand the scale of pig breeding. Especially in recent years, the efficiency of pig breeding in Heilongjiang Province has continued to decline, and the risk of pig breeding epidemic has led to a continuous decline in the pig breeding industry in Heilongjiang Province.

The key to stabilizing the development of the pig breeding industry in Heilongjiang is to improve the efficiency of scale pig breeding and reduce the risk of market fluctuations, which is also the key to promote the realization of pig breeding industry in Heilongjiang Province.

4.2. Analysis on the influencing factors of income change of pig breeding in Heilongjiang Province

From the perspective of the main influencing factors on the change of pig breeding benefits, during the period of 2007-2018, due to the changes of pork price and pork production, the income of pig breeding was constantly changing. Based on the cost-benefit decomposition analysis method, the benefit changes and factor contribution of Heilongjiang pig breeding during 2007-2018 were calculated.

The results are shown in Table 2. According to the calculation results, during this period, the growth rate of the benefits of free range pig breeding and small-scale pig breeding in Heilongjiang Province was significantly lower than the national average level. The growth rate of free-range pig breeding benefit was only 2.2%, and that of small-scale pig breeding was only 8.4%.

The growth rate of the benefits of free-range pig breeding and small-scale pig breeding in China reached 23.0% and 20.6%. In the same period, the growth rate of medium-sized pig farming benefits and large-scale pig farming benefits was close to the national average, and the growth rate of medium-sized and large-scale pig farming were both between 16-18%. Continuing to improve the benefits and advantages of pig breeding in Heilongjiang Province are still the core goals of promoting the development of the pig breeding industry in Heilongjiang Province.

Table 2: Income of pig breeding of different scales in Heilongjiang province and the annual contribution share of influencing factors

		China				Heilongjiang Province			
		Free -range	Small -scale	Medium -sized	Large -scale	Free -range	Small -scale	Medium -sized	Large -scale
growth proportion %	Production effect	12.8	8.5	5.1	5.0	-0.6	5.0	7.6	5.1
	price effect	8.8	11.1	11.7	10.8	2.9	3.2	9.6	11.5
	reciprocal effect	1.3	1.0	0.7	0.7	-0.1	0.2	0.8	0.6
	Aggregation effect	23.0	20.6	17.6	16.5	2.2	8.4	17.9	17.2
essential factor contributio n rate %	contribution production	55.7	41.5	29.0	30.5	-29.0	59.8	42.3	29.8
	contribution price	38.5	53.7	66.8	65.3	132.8	37.9	53.4	66.9
	Interaction contribution	5.8	4.8	4.2	4.1	-3.8	2.2	4.3	3.3
	Total contribution	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The data is calculated based on the data in National Agricultural Product Cost-benefit Data Compilation (2008-2019).

Regarding the main factors affecting the changes of pig income, both the price and output contribution played a very important role in the growth of pig breeding income in Heilongjiang Province during this period. The contribution rate of output growth of small and medium-sized pig breeding in Heilongjiang Province reached more than 40%, and that of large-scale pig breeding reached nearly 30%, which played a positive role in promoting the growth of pig breeding efficiency in Heilongjiang Province. In addition to the output contribution, the price change still plays a key role in the change of pig breeding efficiency. It should be noted that in this period, the contribution of free-range pig production growth in Heilongjiang Province was negative, which indicated that the income growth of free-range pig breeding was largely affected by price, and the individual households were more affected by the market risk and vulnerable to the impact of market risk.

The above results show that moderate promotion of scale pig breeding development in Heilongjiang Province is conducive to improving the efficiency of pig breeding in Heilongjiang Province, stabilizing the development of pig breeding industry in Heilongjiang Province, and promoting the high-quality development of pig breeding industry in

Heilongjiang Province.

5. Empirical analysis and discussion

5.1. Analysis on the change of total cost of pig breeding and its influencing factors

The change of pig breeding cost includes the change of total cost of pig breeding and the change of its constituent elements. The change of the total cost of pig breeding has a direct impact on the benefit of different scale pig breeding, while the change of pig breeding cost components has a direct impact on the change of total cost structure of different scale pig breeding.

This paper mainly analyzes the changes and characteristics of pig breeding cost in Heilongjiang Province through the structural change of total cost and its influencing factors, and compares with the national average production cost to identify the competitive advantage of pig breeding cost in Heilongjiang Province. It can be seen from table 3 that the cost of pig breeding in Heilongjiang Province is slightly lower than the national average level, indicating that Heilongjiang Province has a certain cost advantage. Among them, the cost of free-range pig breeding during 2007-2018 was 1,110 yuan each pig, lower than the average cost of national free-range pig breeding of 1,199 yuan each, which was nearly 90 yuan. The cost of pig breeding above the scale is basically between 1,150 yuan each and 1,160 each, which is significantly lower than the national average.

Table 3: Total cost of per pig breeding of different scales yuan/per pig

Year	China				Heilongjiang Province			
	Free -range	Small -scale	Medium -sized	Large -scale	Free -range	Small -scale	Medium -sized	Large -scale
2007	734.3	809.9	853.8	936.9	827.0	847.3	790.5	785.2
2008	934.6	1062.5	1068.3	1148.6	938.1	1020.3	1016.2	1018.2
2009	867.8	915.6	929.8	1013.3	916.0	937.1	962.8	935.4
2010	934.8	960.7	980.1	1068.9	871.5	913.5	935.7	964.0
2011	1169.9	1197.7	1226.1	1332.8	1112.3	1169.2	1192.4	1196.2
2012	1312.4	1289.8	1324.0	1398.6	1216.8	1333.1	1346.8	1339.2
2013	1356.9	1324.0	1335.4	1404.5	1225.6	1357.6	1310.4	1286.1
2014	1351.0	1278.9	1301.9	1355.6	1168.8	1211.1	1221.6	1209.3
2015	1382.8	1319.6	1306.9	1352.6	1196.3	1217.7	1213.0	1241.1
2016	1522.8	1453.1	1462.1	1513.0	1375.9	1391.8	1389.7	1364.6
2017	1469.9	1375.0	1364.7	1434.7	1300.1	1320.7	1300.7	1311.9

2018	1352.2	1247.7	1244.0	1301.7	1175.6	1178.5	1201.1	1162.1

Note: The data is calculated based on the data in National Agricultural Product Cost-benefit Data Compilation (2008-2019).

However, the pig breeding income of Heilongjiang Province is lower than the national average level in the same period, which leads to different comparative benefit competitive advantages of different scale pig breeding in Heilongjiang Province. During this period, the net income of free-range pig breeding in Heilongjiang Province exceeded the national average by 126 yuan each, while the net income of small-scale pig breeding was 4 yuan higher than the national average.

The net income of medium-sized pig breeding and large-scale pig breeding were 29-35 yuan each lower than the national average level. This result indicates that the medium and large-scale pig breeding in Heilong Province does not have a competitive advantage. During this period, the income growth of pig breeding in Heilongjiang Province did not exceed 210 yuan each, and the cost increase exceeded 350 yuan each, and the profit space became narrow.

From the perspective of pig breeding cost and its influencing factors, the increase in the total cost of pig breeding in this period was mainly caused by the cost of pig breeding, while the impact of quantitative factors decreased. From the aspect of the contribution of quantitative factors, the cost of pig breeding in Heilongjiang province is reduced due to the reduction of input of production factors. Among them, due to the decline in quantitative factors, the cost of raising free-range pigs has dropped by 61.3 yuan each pig, while the cost of small-scale pig breeding has dropped by 30.0 yuan each, which resulted in a large decrease in the cost of pig breeding in both scales. The cost of medium-scale and large-scale pig breeding decreased by only 1.1 yuan and 10.8 yuan respectively.

The cost of free-range pig farming has dropped significantly higher than the national average due to quantitative reasons, while the cost of medium-scale and large-scale pig farming has fallen below the national average during this period. The competitive advantage of the input cost of medium-scale and large-scale pig breeding is gradually lost. In terms of the increase in the breeding price cost per pig in Heilongjiang Province, except for the increase in the total cost caused by the price factor of free-range pig breeding which is significantly higher than the national average level, the cost of pig breeding of other scales is significantly higher than the national average level due to the price factor. Among them, due to the increase in the price of production factors, the cost of small-scale pig breeding increased by 327.2 yuan each pig, that of medium-sized pig breeding increased by 341.7 yuan each, and the large-scale pig breeding increased by 354.7 yuan due to the increase in cost, which were 14.8 yuan, 23.3 yuan and 28.2 yuan respectively higher than the national average

level. The results showed that the cost of pig breeding in Heilong Province was greatly affected by price factors during this period, and the growth rate of pig breeding cost above scale was higher than the national average level, and the competitive advantage of pig breeding cost gradually lost. Therefore, controlling and reducing the price of input factors of pig breeding in Heilongjiang Province is conducive to improving the pig breeding income of Heilong Province.

5.2. Analysis on individual cost of pig breeding and its influencing factors

The components of the total cost of pig breeding include feed cost, piglet cost, labor cost, water and electricity fee, management fee and other expenses. Among the total cost components of pig breeding in Heilongjiang Province, the feed cost accounts for more than 50% of the total cost, the cost of piglets accounts for 30% of the total cost, the labor cost accounts for 15% of the total cost, the three expenses account for more than 95% of the total cost, and other expenses account for less than 5% of the total cost.

As other expenses are too miscellaneous and account for a low proportion, this paper mainly analyzes the change trend and influencing factors of feed cost, piglet cost and labor cost. The specific decomposition calculation results are shown in Table 4.

Table 4: Cost composition of pig breeding in Heilongjiang province and contribution share of each cost influencing factor

		Influencing factor	China				Heilongjiang Province			
			Free -range	Small -scale	Medium -sized	Large -scale	Free -range	Small -scale	Medium -sized	Large -scale
Cost share yuan/per pig	feed cost	price	117.2	147.0	173.7	178.9	146.6	149.2	149.1	164.1
		quantity	70.0	37.9	-0.7	-6.3	4.5	30.9	20.6	11.2
		total	187.2	184.9	173.1	172.6	151.1	180.1	169.7	175.4
	piglet cost	price	69.8	69.4	80.8	98.7	59.3	62.7	92.5	98.7
		quantity	15.7	-1.0	-15.4	-19.9	-17.0	-24.8	-8.2	-16.1
		total	85.5	68.4	65.4	78.8	42.3	37.8	84.3	82.7
	labor cost	price	161.2	95.9	63.8	49.0	120.5	115.3	100.1	49.0
		quantity	-33.4	-30.5	-18.7	-22.0	-48.7	-36.1	-13.5	-6.0
		total	127.9	65.4	45.1	27.0	71.8	79.2	86.5	43.0
Contribution rate	feed cost	price	62.6	79.5	100.4	103.7	97.0	82.8	87.9	93.6
		quantity	37.4	20.5	-0.4	-3.7	3.0	17.2	12.1	6.4
	piglet cost	price	81.6	101.5	123.6	125.2	140.3	165.6	109.7	119.4

%		quantity	18.4	-1.5	-23.6	-25.2	-40.3	-65.6	-9.7	-19.4
	labor cost	price	55.8	59.4	58.6	64.5	62.7	59.3	53.6	53.3
		quantity	44.2	40.6	41.4	35.5	37.3	40.7	46.4	46.7

Note: The data is calculated based on the data in National Agricultural Product Cost-benefit Data Compilation (2008-2019).

Table 4 shows that feed cost is the main factor affecting the growth of pig breeding cost in Heilongjiang Province, accounting for more than 50% of the total cost growth. From the main factors affecting the rise of feed cost, the increase of feed cost is mainly caused by the rise of feed price. Due to the increase of feed price, the total cost of pig breeding increased by more than 40%.

Among them, the cost of free-range, small-scale and medium-scale pig breeding has increased by nearly 150 yuan per pig due to the increase in feed prices, and the increase in feed cost for large-scale breeding is even higher at 164.1 yuan. Compared with the national average, although price factors have caused the increase in the cost of pig farming above scale in Heilongjiang Province to be slightly lower than the national average, the amount of feed input in Heilongjiang Province during the same period was higher than the national average, resulting in the increase in total cost close to or even higher than the national average level.

During this period, except for the increase in the cost of the free-range feed, which was significantly lower than the national average, the increase in the cost of the rest of the feed was higher than or close to the national average. Secondly, the cost of piglets breeding in Heilongjiang Province also increased slightly during this period, which was mainly caused by the rise of the price of piglets. During this period, the cost of free-range breeding increased by 42.3 yuan each pig, that of small-scale breeding increased by 37.8 yuan each, and that of medium-sized and large-scale pig breeding increased by 84.3 yuan and 82.7 yuan respectively.

The piglet cost of large-scale pig breeding increased significantly affected the benefits of large-scale pig farms. Compared with the national average, the growth rate of the piglet cost of free-range and small-scale pig breeding in Heilongjiang Province is lower than the national average, which is conducive to enhancing the competitive advantage of small-scale pig breeding.

However, the cost of medium-sized and large-scale pig breeding increased significantly and was higher than the national average level in the same period, which led to the decline of cost competitive advantage. Finally, from the increase of labor cost, the labor cost of pig breeding in Heilongjiang Province also increased significantly, which was mainly caused by the rise of labor price. Compared with the national average level, the growth rate of

labor cost above scale is significantly higher than the national average level, except that the increase rate of labor cost of free range pig is less than the national average level.

The average annual increase of labor cost of small-scale pig breeding is close to 80 yuan each pig, that of medium-sized pig breeding is more than 85 yuan each, and that of large-scale pig breeding is more than 40 yuan, which is higher than the national average level of 13.8 yuan, 41.5 yuan and 16 yuan. During this period, the labor cost of pig breeding above scale was generally higher than the national average except for the free-range scale. The substantial increase in the cost of pig breeding above scale in Heilongjiang Province further weakened the cost advantage of pig breeding above designated size.

6. Conclusions and Recommendations

The benefit of pig breeding in Heilongjiang Province has improved slightly since 2007. More specifically, the price plays a greater role in improving the efficiency of pig breeding, while the impact of pork production on the growth of pig breeding efficiency is relatively small. Compared with the national average, the changes of pig breeding benefits of different scales were slightly different during this period.

The competitive advantages of free-range and small-scale pig breeding are relatively obvious, but the competitive disadvantages of medium-scale and large-scale pig breeding are more prominent. From the perspective of cost analysis, the increase in the price of input factors for pig breeding in Heilongjiang Province is the main driving force leading to the increase in pig breeding costs. The factor decomposition analysis method is further used to analyze the cost components and elements of pig breeding of different scales since 2007.

The results show that the increase in feed costs is the first element leading to the increase in pig breeding costs, followed by the increase in labor costs and the rise of piglet price. Among them, the increase in the price of production factors has an obvious effect on the increase of pig breeding cost, and the increase in the number of input factors of production has a relatively small effect on the increase of pig breeding cost, and even has a certain inhibitory effect on the growth of pig breeding cost in different years and scales. During this period, the cost of pig breeding increased significantly, which significantly affected the net benefit growth of pig breeding in Heilongjiang Province, which was not conducive to stimulating the enthusiasm of pig farmers. In addition, it should be noted that compared with the national average level, Heilongjiang Province has obvious competitive disadvantage for medium-scale and above-scale pig breeding, which is not conducive to promoting the scale

development of pig breeding.

According to the above analysis results, in order to further improve the efficiency of pig breeding in Heilongjiang Province, it is necessary to take active measures to improve the efficiency of pig breeding and reduce the cost of pig breeding in Heilongjiang. First of all, from the aspect of breeding efficiency, it is necessary to improve the breed, increase the feed conversion rate, reduce the mortality rate of pig breeding, and increase the meat yield of pig breeding. Breed is the primary condition to improve the economic benefit of breeding. The quality of breed directly determines the production performance, feed consumption, feeding cycle and feed-to-meat ratio of pig.

It is necessary to develop an appropriate scale of operation, improve the level of scientific breeding, achieve scientific breeding and management, reduce morbidity and mortality, shorten the breeding cycle, and save the cost of breeding to achieve maximum economic benefits. It is necessary to change the state of low-level and excessive competition in scale operation and enhance the market competitiveness of scale operation enterprises. Secondly, in terms of the cost of pig breeding, it is necessary to consolidate the foundation for the development of the pig breeding industry, especially focusing on supporting the development of the sow breeding industry, increasing the quantity and quality of the supply of piglets to reduce the supply price. At the same time, the concentrated feed resources required for pig breeding should be vigorously developed. In recent years, the prices of corn and soybean meal for concentrate feed have risen sharply, which has swallowed up the economic benefits of pig breeding.

To reduce the breeding cost, it is necessary to fully tap the feed return rate, expand the source of feed, study the low-cost and high-efficiency feed formula, improve the breeding level of farmers and reduce the feeding cost. In addition, it can also promote the mechanization of the pig breeding industry to reduce the use of artificial elements, and reduce the labor cost of the unit pig breeding by expanding the scale of breeding, and improve the economic benefits of pig breeding. Third, to build a high-quality production base, it is necessary to focus on the development of moderate scale high-quality breeding industry and restructure the pig industry chain. Price played an important role in the growth of pig breeding efficiency during this period. Relying on high-quality pig industry resources, supporting the development of moderate scale high-quality farms (households), building a high-quality and high-value industrial chain, and enhancing the market competitive advantage of the whole industry chain, so as to obtain higher market benefits.

At the same time, a regional pig brand of "Longjiang" can be created, focusing on

improving the price and market competitiveness of enterprises above the scale. Transform the traditional low-level and over-decentralized business model, promote the integration and innovation of the pig industry chain, create the "Longjiang" pig brand, and realize the integration, innovation and value-added of the whole industrial chain.

7. References

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