Regional Differences in the Income of Farmers and Herdsmen in Inner Mongolia

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Abstract　This paper analyzes the key indicators which reflect farmer and herdsman's income in Inner Mongolia region，and then carries out regression analysis，factor analysis and cluster analysis of their income status in this region with SPSS software. Through the analysis，it can be seen that the net income of per farmer and herdsman in Inner Mongolia，has not reached the national level，and the differences in the influencing factors of the income are very obvious. According to present specific situation of farmers and herdsman in Inner Mongolia，this paper gives suggestions like proposing an agricultural prices security system，speeding up the strategic investment，improving the investment environment to promote the reasonable layout of the whole area，so as to improve the incomes of famers and herdsmen in Inner Mongolia region.

Key words　Inner Mongolia，Economic development，Influencing factors，Price protection system

1　Introduction

Inner Mongolia Autonomous Region，is an autonomous region of the People's Republic of China，located in the northern region of the country. Inner Mongolia shares an international border with Mongolia and Russia. Its capital is Hohhot. Other major cities include Baotou，Chifeng，and Ordos. It is the third-largest subdivision of China spanning about 1 200 000 km² or 12% of China's total land area. It has a population of 24 706 321 as of 2010 census，sharing 1.84% of Mainland China's population，Inner Mongolia is the 23rd populous province-level division. Due to the great expanse，there are great differences in resource endowments and levels of economic development between the leagues or cities，and the regional differences in the per capita net income of farmers and herdsmen are obvious. Since the reform and opening up in 1978，China's economy has maintained rapid growth，and especially in 2006 and 2007，China's GDP growth rate reached 10.7% and 11.4%，respectively. During the "Eleventh Five – Year" period，the economic development was dramatic in rural pastoral areas of Inner Mongolia，and the food production continued to hit new highs；the prices of agricultural and livestock products rose，and the non-farm employment opportunities of farmers and herdsmen increase，with rising wage rates；the state and the autonomous region intensified subsidy to " agriculture，countryside and farmers".

Despite the economic boom and constantly rising living standards of residents in recent years，the income gap between urban and rural residents in Inner Mongolia is expanding and this widening gap still continues，from the Gini coefficient as a measure of income distribution gap. From 2000 to 2008，the average annual growth rate of per capita GDP in Inner Mongolia was 17.3%，but disposable income growth rate of urban residents was only 11.3%

in the same period，and per capita net income growth rate of farmers and herdsmen was only 8.7%，which was significantly lower than GDP growth rate. In 2008，the per capita GDP in Inner Mongolia was equivalent to 146.3% of the national average，but the per capita net income of farmers and herdsmen was 4 656 yuan，equivalent to only 97.8% of the national average. And in 2009 this figure fell to 95%.

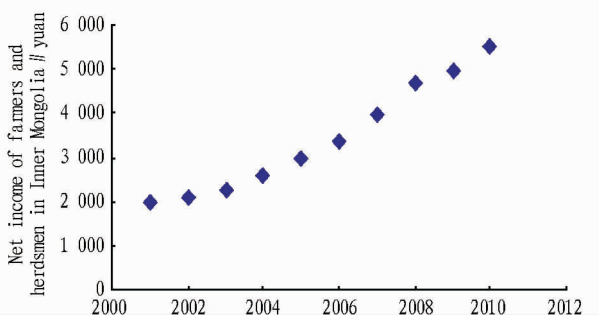## 2　Current situation of income of farmers and herdsmen in Inner Mongolia

2.1　Per capita net income of farmers and herdsmen　The income of farmers and herdsmen has grown rapidly，and Inner Mongolia continues to strengthen various policies for benefiting agriculture and animal husbandry，make every effort to broaden the income channels for the farmers and herdsmen，and adopt various measures to increase farmers' income. Per capita net income of farmers and herdsmen was increased from 2 086 yuan in 2002 to 5 530 yuan in 2010，and it even reached 12% in 2010.

At present，the ranking of the per capita income of farmers and herdsmen in Inner Mongolia among provinces and autonomous regions in the country has risen from 22nd in 2002 to 16th，leading the western provinces for nine consecutive years.

Table 1　The growth of income of farmers and herdsmen in Inner Mongolia during the period 2001 −2010　　Unit：yuan/person

Year	Net income
2001	1 973.37
2002	2 086.02
2003	2 267.65
2004	2 606.37
2005	2 988.87
2006	3 341.88
2007	3 953.10
2008	4 656.18
2009	4 937.8
2010	5 529.6

In 2005, the per capita cash income of farmers and herdsmen in Inner Mongolia was 2 988.87 yuan, and increased to 5 529.6 yuan in 2010, an average annual increase of 13.1%, 0.4 percentage points higher than the national average growth rate. In 2006, 2007, 2008, 2009 and 2010, the net income of farmers and herdsmen reached 3 341.9 yuan, 3 953.1 yuan, 4 656.2 yuan, 4 937.8 yuan and 5 529.6 yuan, respectively, an increase of 11.8%, 18.3%, 17.8%, 6.1% and 12.0%.

Fig. 1   The scatter plot of net income of farmers and herdsmen in Inner Mongolia during the period 2001 − 2010

As can be seen from Fig. 1, the per capita net income of farmers and herdsmen Y, changes exponentially with time t. According to the characteristics of scatter plot, the exponential model of Y and t is established:

$$Y = ab^t$$

Take logarithm of both sides: $\ln Y = \ln a + t \times \ln b$.

We use the logarithm of per capita net income of farmers and herdsmen in Inner Mongolia during the period 2001 − 2010 to carry out year regression. The value was 1 in 2001 and 10 in 2010. The regression analysis is carried out in SPSS and we get the following table results.

Table 2   The model summarization

Model	R	R^2	Adjusted R^2	Standard error of estimate
1	0.983	0.967	0.963	0.582

As can be seen from Table 2, the coefficient of determination R = 0.983, indicating that the year explains 98.3% of total variance of net income of farmers and herdsmen.

As can be seen from Table 3, at the 5% significance level, the regression coefficients pass t test, and p value is very small, close to 0. It indicates that the regression effect is good, and we get the following regression equation:

$$\ln Y = 1997.477 + 0.002 \times t$$

We further get the function relationship between rural and pastoral per capita net income and year:

$$Y = e^{997.477 + 0.002 \times t}$$

Table 3   Per capita net income of farmers and herdsmen-annual regression coefficient table

a. Dependent variable: year

Model	Non-standardized coefficient		Standard coefficient	t	Sig.
	B	Standard error	Trial version		
1 (Constant)	1 997.477	0.555		3 602.096	0.000
Net income	0.002	0.000	0.983	15.338	0.000

2.2   Changes in the structure of per capita net income of farmers and herdsmen

2.2.1   The monetization of income form. With agricultural production socialization and accelerated marketization process, the self-sufficient peasant economy has been gradually replaced by the market economy. The constant growth of wage income, property and transfer income promotes the cash income of farmers and herdsmen to increase rapidly (Table 4).

In 2005, the per capita cash income of farmers and herdsmen in the region was 2 462.5 yuan, and it reached 4 575.1 yuan income in 2010, five-year increase of 2 112.6 yuan, an average annual increase of 422.5 yuan. The proportion of cash net income to annual net income also increased from 82% in 2005 to 82.7% in 2010.

Table 4   The structure of per capita income of farmers and herdsmen in Inner Mongolia during the period 2001 − 2010   Unit: yuan/person

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Wage income	300.11	320.03	344.60	394.79	504.46	590.70	716.86	806.48	900.42	1 036.8
Family operating income	1 622.47	1 694.4	1 818.78	2 037.70	2 223.26	2 406.21	2 786.0	3218.0	3 277.5	3 669.9
Transfer and property income	50.79	71.59	104.28	173.88	261.15	344.97	450.16	631.69	759.89	822.9

2.2.2   The diversification of income sources. Inner Mongolia is a traditional agricultural and pastoral area, and the income structure of farmers and herdsmen has long been simple. But in recent years the situation has changed. The proportion of family operating income to net income continuously declines, and the proportion of wages, property, transfer and other non-farming incomes is gradually increased, so there is a trend of diversification of income of farmers and herdsmen in this region. A lot of financial subsidies have broadened the income sources, and directly contribute to the increase in farmer income.

In 2010, the per capita wage income of farmers and herdsmen reached 1036.8 yuan in this region, accounting for 18.2% of net income, an increase of 1.9 percentage points compared with 2005; the property net income reached 164.3 yuan, accounting for 3% of net income, an increase of 0.6 percentage points compared with 2005; the transfer net income reached 658.6 yuan, accounting for 11.9% of net income, an increase of 5.6 percentage points compared with 2005.

Meanwhile, it can be seen from Fig. 2 that the proportion of transfer and property incomes shows relatively stable upward trend over the past 10 years, and the proportion is increasingly higher; the proportion of family operating income shows a clear downward

trend, and despite the absolute proportion, the proportion declines significantly; the proportion of wage income is small, and the change is relatively stable, without clear upward or downward trend.
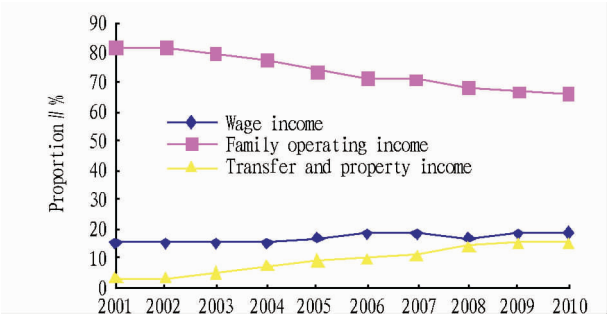

Fig. 2　The line chart of proportion composition of per capita net income of farmers and herdsmen

2.2.3　Stably ranking first among the 12 western provinces and municipalities. In 2001, the CPC Central Committee launched the western development strategy initiatives. The western regions refer to Shaanxi, Gansu, Ningxia, Qinghai, Xinjiang, Sichuan, Chongqing, Yunnan, Guizhou, Tibet, Guangxi, and Inner Mongolia.

　　During the " Eleventh Five-Year" period, the income of farmers and herdsmen in Inner Mongolia was always in the first place among 12 provinces, autonomous regions and cities. In 2005,

the income was 180 yuan higher than that of Chongqing which was in the second place; the income was 1112 yuan higher than that of Guizhou Province which was at the bottom. The income was 253 yuan higher than that of Chongqing which was in the second place; the income was 2 105 yuan higher than that of Gansu Province which was at the bottom.

3　Empirical analysis of economic integration in Inner Mongolia

Due to the great expanse, there are great differences in resource endowments and levels of economic development between the leagues or cities, and the regional differences in the per capita net income of farmers and herdsmen are obvious. In order to better analyze the per capita net income of farmers and herdsmen in various regions, we use factor and cluster analysis to classify the 12 leagues and cities in Inner Mongolia Autonomous Region.

　　To further understand the net income of farmers and herdsmen in Inner Mongolia, we use the published statistics on some leagues and cities of Inner Mongolia (Table 5), and use modern statistical methods to process these data for analysis. We carry out KMO test and Bartlett's test of sphericity on some economic indicators in various leagues and cities of Inner Mongolia in 2009 (Table 6), and KMO test value is 0.632, indicating that there is correlation between the original variables, suitable for factor analysis.

Table 5　Some economic indicators on leagues and cities in Inner Mongolia in 2009

Regions	Annual household income of farmers and herdsmen	Electricity consumption	Crop growing area	Total power of agricultural and animal husbandry machinery	The number of persons with education level of high school per one hundred labor forces	Added value of service industry in agriculture, forestry, animal husbandry and fishery	Added value of secondary industry	Added value of tertiary industry	Chemical fertilizer application rate	Rate of non-farm and livestock practitioners
Hohhot	11 926.37	29 555	441 374	185.04	15.19	14 394.33	501.9	739.3	91 840	0.242
Baotou	11 262.23	27 482	304 610	136.62	22.43	13 309.15	1003.93	703.99	66 924	0.252
Hulunbeier	8 967.08	40 014	1 521 336	334.56	8.08	37 842.98	230.45	258.2	77 231	0.152
Xing'an	5 087.07	15 206	735 860	332.39	13.81	16 447.37	50.26	61.66	132 287	0.039
Tongliao	7 957.73	56 103	1 078 330	502.31	14.19	29 599.40	411.29	229.41	439 757	0.114
Chifeng	6 969.23	100 387	1 051 190	395.13	14.15	42 148.09	375.21	233.63	243 510	0.250
Xilin Gol	9 700.64	5 135	2 26 256	107.66	12.35	16 755.34	250.52	96.54	10 947	0.481
Wulanchabu	5 822.25	20 567	582 452	172.23	9.50	29 890.59	211.51	140.9	92 786	0.109
Erdos	11 468.63	20 614	372 103	244.66	11.69	20 151.21	931.43	613.92	149 350	0.423
Bayannur	12 578.25	37 038	508 534	338.39	17.17	25 021.95	229.61	116.79	217 656	0.148
Wuhai	12 439.85	2 933	7 401	7.84	13.43	1 233.92	158.88	78.46	7388	0.299
Alashan	13 071.39	9 980	31 380	22.61	22.54	3 213.65	136.68	38.67	11304	0.737

Table 6　KMO and Bartlett's test

Kaiser – Meyer – Olkin Measure of Sampling Adequacy	Bartlett's sphericity test		
	Approximate chi-square	df	Sig.
0.632	68.134	36	0.001

　　Table 7 shows the eigenvalues and variance contribution rate at various stages of the factor analysis, and there are three factors with eigenvalues greater than 1. The two corresponding common

factors should be extracted. At the same time it can be seen that the first three factors can explain 84.572% variance of the original variables, and have already contained most of the information.

The rotated coefficient of load has been clearly differentiated (Table 8). The first common factor has a greater load on Rate of non-farm and livestock practitioners and the number of persons with education level of high school per one hundred labor forces, indicating that these indicators have higher correlation and can be classified as a class, named social factors.

The second common factor has a great load on added value of secondary industry and added value of tertiary industry, indicating that there is correlation between these indicators. They can be classified as a class, named social factors.

The third common factor has a great load on electricity consumption, crop growing area, total power of agricultural and animal husbandry machinery, added value of service industry in agriculture, forestry, animal husbandry and fishery and chemical fertilizer application rate. They can be also classified as a class, named agricultural and animal husbandry factor.

Table 7   Total variance explained

Factor	Initial eigenvalues			IExtract sum of squares and load			Rotate sum of squares and load		
	Total	Variance//%	Cumulative//%	Total	Variance//%	Cumulative//%	Total	Variance//%	Cumulative//%
1	4.543	50.473	50.473	4.543	50.473	50.473	3.700	41.115	41.115
2	2.024	22.486	72.958	2.024	22.486	72.958	2.015	22.388	63.503
3	1.045	11.614	84.572	1.045	11.614	84.572	1.896	21.069	84.572
4	0.642	7.136	91.708						
5	0.354	3.928	95.636						
6	0.192	2.134	97.770						
7	0.122	1.361	99.131						
8	0.048	.534	99.665						
9	0.030	.335	100.000						

Table 8   Rotated component matrix

	Component		
	1	2	3
Electricity consumption	0.893	−0.051	0.103
Crop growing area	0.714	−0.589	−0.055
Total power of agricultural and animal husbandry machinery	.906	−0.322	0.003
The number of persons with education level of high school per one hundred labor forces	−0.013	0.925	0.151
Added value of service industry in agriculture, forestry, animal husbandry and fishery	0.743	−0.542	0.010
Added value of secondary industry	0.069	0.149	0.954
Added value of tertiary industry	0.007	−0.009	0.974
Chemical fertilizer application rate	0.901	−0.018	0.030
Rate of non-farm and livestock practitioners	−0.451	0.625	−0.017

Table 9   Component score coefficient matrix

	Component		
	1	2	3
Electricity consumption	0.325	0.211	−0.006
Crop growing area	0.110	−0.211	−0.007
Total power of agricultural and animal husbandry machinery	0.258	0.031	−0.026
The number of persons with education level of high school per one hundred labor forces	0.254	0.649	−0.040
Added value of service industry in agriculture, forestry, animal husbandry and fishery	0.130	−0.178	0.020
Added value of secondary industry	−0.004	0.000	0.503
Added value of tertiary industry	−0.076	−0.136	0.541
Chemical fertilizer application rate	0.343	0.247	−0.051
Rate of non-farm and livestock practitioners	0.009	0.325	−0.058

By the observed common factor values, the factor score coefficient matrix is given. According to the factor score coefficients and the normalized value of the original variables in Table 9, we calculate the factor score of each observed value.

Using the above economic factors and farming and animal husbandry factors obtained from the factor analysis results, we carry out the clustering of 12 leagues and cities in Inner Mongolia, and the cluster analysis results using SPSS are as follows:
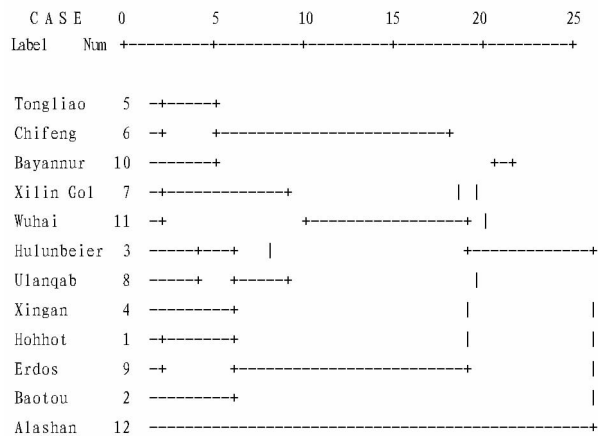
The first category: Hohhot, Baotou, Ordos;

The second category: Wuhai, Xilin Gol, Xingan, Ulanqab, Hulunbeier;

The third category: Tongliao, Chifeng, Bayannur;

The fourth category: Alashan.

From the clustering results, the cities of the first category are the three cities with the highest level of added value of secondary and tertiary industries.

In addition to Erdos, the farmers and herdsmen in Hohhot and Baotou are relatively well educated. In the cities of the second category, the educational level of farmers and herdsmen is considerably lower. In the cities of the third category, the values in the electricity consumption and total power of agricultural and animal husbandry machinery are high. In the cities of the fourth category,

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C A S E    0        5         10        15        20        25
Label    Num  +---------+---------+---------+---------+---------+

Tongliao    5  -+-----+
Chifeng     6  -+        +-----------------------+
Bayannur   10  -------+                              +-+
Xilin Gol   7  -+-------------+                       | |
Wuhai      11  -+            +------------------+     | |
Hulunbeier  3  -----+---+    |              +-------------+
Ulanqab     8  -----+   +-----+              |             |
Xingan      4  ---------+                    |             |
Hohhot      1  -+-------+                    |             |
Erdos       9  -+        +------------------------+        |
Baotou      2  ---------+                                  |
Alashan    12  -----------------------------------------------+
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Fig. 3   Tree diagram of the net income of farmers and herdsmen in Inner Mongolia

the rate of non-farm and livestock practitioners and the educational level are both high.

4   Analysis of the main problems

4.1   The per capita net income of farmers and herdsmen has not yet reached the national average, especially lagging behind that of the developed regions   The per capita net income of farmers and herdsmen in Inner Mongolia has not yet reached the national standard of per capita net income of farmers. In 1990, the per capita net income of farmers and herdsmen in Inner Mongolia was 647 yuan, and the national average was 686 yuan, 39 yuan lower than the national average; in 2000, the per capita net income of farmers and herdsmen in Inner Mongolia was 2 038 yuan, and the national average was 2 253 yuan, 215 yuan lower than the national average; in 2005, the per capita net income of farmers and herdsmen in Inner Mongolia was 2 989 yuan, and the national average was 3 255 yuan, 266 yuan lower than the national average; in 2006, the per capita net income of farmers and herdsmen in Inner Mongolia was 3 342 yuan, and the national average was 3 587 yuan, 245 yuan lower than the national average; in 2007, the per capita net income of farmers and herdsmen in Inner Mongolia was 3 953 yuan, and the national average was 4 140 yuan, 187 yuan lower than the national average; in 2008, the per capita net income of farmers and herdsmen in Inner Mongolia was 4 656 yuan, and the national average was 4 761 yuan, 105 yuan lower than the national average; in 2009, the per capita net income of farmers and herdsmen in Inner Mongolia was 4 938 yuan, and the national average was 5 153 yuan, 215 yuan lower than the national average; in 2010, the per capita net income of farmers and herdsmen in Inner Mongolia was 5 530 yuan, and the national average was 5 919 yuan, still 389 yuan lower than the national average.

It can be seen that from 1990 to 2005, the gap between the per capita net income of farmers and herdsmen in Inner Mongolia and the national average showed an increasingly widening gap; from 2006 to 2008, the gap between the per capita net income of farmers and herdsmen in Inner Mongolia and the national average was gradually narrowed; from 2009 to 2010, the gap between the per capita net income of farmers and herdsmen in Inner Mongolia and the national average was widened again.

4.2   The sources of income of farmers and herdsmen are relatively simple, and the actual growth rate of per capita net income is slow   In 2009, the wage income accounted for 18.23% of the per capita net income of farmers and herdsmen in Inner Mongolia; the family operating income accounted for 66.38% of the per capita net income of farmers and herdsmen in Inner Mongolia; the transfer and property income accounted for 15.39% of the per capita net income of farmers and herdsmen in Inner Mongolia. In the same period, the wage income accounted for 40% of national per capita net income of farmers and herdsmen; the family operating income accounted for 49.03% of national per capita net income of farmers and herdsmen; the transfer and property income accounted for 10.97% of national per capita net income of farmers and herdsmen. The proportion of family operating income from the primary industry is more than 90% in Inner Mongolia and about 78% in the country. We can see that the per capita net income of farmers and herdsmen in Inner Mongolia is mainly from family operating income and especially the farming and animal husbandry income; the proportion of wage income is low, and the source of income is relatively simple.

4.3   The sharp increase in the production material prices of farming and animal husbandry makes the production costs climb and restricts the income increase   In 2010, the overall level of consumer prices in Inner Mongolia rose by 3.2% (3% of rise in the cities and 3.5 of rise in the rural and pastoral areas). From the prices of production materials, the rise in the prices of production materials for farm and pasture products is the highest, reaching 11.4%. This would increase the cost of farming and animal husbandry production, and decrease the economic benefit.

4.4   The natural disasters are serious, affecting the income increase of farmers and herdsmen   From late 2010 to early 2011, the snow and drought disasters were serious in Inner Mongolia. Severe snow disaster area was 210918 square kilometers, and moderate snow disaster area was 64783 square kilometers; the snow depth was 21 – 39 cm in most of Hulunbeier, northwestern Xing'an and northwestern Xilin Gol, continuous time of up to 100 days, and 70% of pasture was buried.

Meanwhile, the drought was serious in rural and pastoral areas, and the region's severe drought area reached 280000 square kilometers. Snow and drought disasters will bring some degree of adverse effects on the production of farming and animal husbandry, thereby increasing the difficulty of income increase for farmers and herdsmen.

5   Conclusions and recommendations

5.1   Establishing the price protection system for farming and animal husbandry products   Farming and animal husbandry is the main source of income for farmers and herdsmen in Inner Mongolia, and the establishment of price protection system will not only help to maintain the stable development of farming and animal

husbandry production, but also help to ensure the income and life quality of farmers and herdsmen, and resolve the regional income gap of farmers and herdsmen.

5.2 Accelerating the strategic input and improve the investment environment Accelerating the strategic input is to increase the input for long-term development and resource advantages. It is necessary to choose those investment projects that can fundamentally have a sustainable impact on economic development.

5.3 Actively improving the urbanization in various leagues and cities Small towns are important for the economic development of rural and pastoral areas. Small towns provide a gathering place for population in rural and pastoral areas and surplus labor, and create more non-farm employment opportunities for the surplus labor in rural and pastoral areas. The development of non-farm and livestock industries in turn further strengthens the urban construction. Therefore, the development of small towns is the need of further development of non-farm industry and small towns can promote the township enterprises to conglomerate to reduce costs and improve efficiency.

5.4 Actively promoting the farming and animal husbandry industry structure transformation It is necessary to accelerate the transformation of traditional farming and animal husbandry production techniques, to gradually realize the modernization of agricultural means of production. At the same time, it is necessary to accelerate the region's non-agricultural and non-animal husbandry development, and increase the share of modern agriculture and animal husbandry industry in the overall economic development of farming and animal husbandry, to enhance its economic competitiveness, thus speeding up the transformation of the regional eco-

nomic structure, and promoting the transformation of overall economic pattern in the rural and pastoral areas.

5.5 Strengthening regional economic integration and economic exchanges Good economic ties are the basic conditions for each region to effectively get a variety of production inputs. In the extensive economic exchanges and contacts, the rich resources and labor advantages of all regions can get the financial and technical support of developed areas, so that the potential advantages become a reality, and the industry in the rural and pastoral areas truly becomes the leading force for non-farm and non-animal husbandry development in the rural and pastoral areas.

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information of these two products can be denoted as $X_A = (0, 50, 6, 1)$ and $X_B = (1, 180, 18, 1, 0)$, and suppose the

threshold as 0.75. According to formula (2), we can calculate the probability of these two products being best selling products:

$$\hat{p}_A = \frac{\exp(-2.69 + 0.01 \times 50 - 0.15 \times 6 + 4.482 \times 1)}{1 + \exp(-2.69 + 0.01 \times 50 - 0.15 \times 6 + 4.482 \times 1)} = 0.8009$$

$$\hat{p}_B = \frac{\exp(-2.69 - 2.72 + 0.01 \times 180 - 0.15 \times 18 + 2.672 \times 1)}{1 + \exp(-2.69 - 2.72 + 0.01 \times 180 - 0.15 \times 18 + 2.672 \times 1)} = 0.0256$$

Since $\hat{p}_A > 0.75$, $\hat{p}_B < 0.75$, we can conclude that Product A is a potential best seller, while Product B is a middle run. Decision makers can formulate or adjust promotion and marketing strategies separately according this condition.

3 Conclusions

Varied information can be used to classify products. We set up classification method on the basis of Logistic Regression Model. Using this method, we can take full advantage of information in product database, and accordingly find factors influencing best selling degree of products. This method not only can be used to objectively and correctly classify "old products", but also can be used to judge whether new products can become best selling products, so as to provide importance reference for decision makers

formulating individualized promotion strategies. However, the prediction function of this classification method should be exercised at market, need proper use of agricultural product enterprises, accurate and complete information. Only through this, may functions of this method be brought into play.

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