Mixture Models of Human Resource Management Flexibility and Firm Performance

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***Abstract*—Numerical flexibility and functional flexibility are the two dimensions of human resource flexibility.The mixtures of the two dimensions form four models.They are HH model(high functional flexibility and high numerical flexibility), LL model (low functional flexibility and low numerical flexibility), LH model(low functional flexibility and high numerical flexibility) and HL model (high functional flexibility and low numerical flexibility).The various mixture models differ from firm performance. Principal Component Analysis is used in this paper to find which model contributes much more to firm performance.It is demonstrated that in Chinese firms HL model is more effective for firm performance than other models.**

Keywords- Functional Flexibility; Numerical Flexibility; HR Flexibility; Firm Performance

I. INTRODUCTION

Human resource flexibility has been seen as playing a key role in the drive for competitiveness and firm performance[1]. Two dimensions are discussed in flexibility,that is,numerical flexibility and functional flexibility[2].Numerical flexibility is the ability of firms to vary the amount of labour employed,by making use of part-time,temporary and seasonal employees,short fixed-term contracts,agency labour,etc.(Michie & Quinn2001)[3]. Functional flexibility is the ability of firms to vary the amount and type of labour they use without resorting to the external labour market, and is accomplished primarily by having a labour force that is able to carry out a wide range of tasks–that is, the ability to move workers from one task to another.It has been demonstrated that human resource flexibility can influence firm performance (Blyton ,1997)[4]. But the two dimensions of flexibility construct four different mixtures[5]. Do the different mixtures contribute equally to firm performance? Further research is needed in this area.

So the purpose of this paper is to find the difference among the mixture models related to firm performance. In the first part four mixture models of flexibility are introduced.And then indicators to measure flexibility and firm performance are designed. And the next section shows the results. The final section concludes.

II. MIXTURE MODELS OF HUMAN RESOURCE FLEXIBILITY AND FIRM PERFORMANCE

As for numerical flexibility and functional flexibility,four mixtures are suggested in this paper. HH model is defined as high functional flexibility and high numerical flexibility. LL model is defined as low functional flexibility and low numerical flexibility. LH model is defined as low functional flexibility and high numerical flexibility. HL model is defined as high functional flexibility and low numerical flexibility.In the four models,HH and LL model are balanced models.HL and LH models are unbalanced models. Figure 1 shows this typology of mixtures.

		Numerical Flexibility	
		High	Low
Functional Flexibility	High	HH	HH
	Low	LH	LL

Figure 1. The Model of flexibility mixture

Functional flexibility and numerical flexibility may play different roles in firm performance.The difference in employee's ability should influence firm performance.So it is suggested that firm performance is better in HH model than in LL model. The performance between HL model and LH model is still in discussion.

Demonstration for Chinese firms will be carried out to test which model contributes much more to firm performance in the next section.

III. MEASURES

A. Measures of Firm Performance and Human Resource Flexibility

Objective and subjective measures are used in measuring firm performance and human resource flexibility. In addition, the data used in this analysis are collected at the firm level. The questionnaires are send by E-mail to top

managers,human resource managers,product managers and marketing managers to get the details.

Five indicators are used in this paper to measure performance. Human resource cost(x_1) (Candelaria,2003)[6], output per employee((x_2) (Huselid,1995)[7],product quality(x_3) (Candelaria,2003),product cost(x_4) (Arthur,1994)[8], customer satisfaction(x_5) (Candelaria,2003). All the measures are asked by one questions.

13 terms are designed to measure functional flexibility.After Principal Component Analysis,functional flexibility will be classified by dimensions and then to get a functional flexibility index to mearsure functional flexibility level.

Only one indicator is used in this paper to mearsure numerical flexibility.That is employees in short term contracts as a percentage of total employees. This indicator is directly used to measure numerical flexibility level.

B. Principal Component Analysis

Principal Component Analysis (PCA) is used to know how many dimensions are in functional flexibility and firm ferpormance. Mixture models will be defined and firm performance will be ranked by scores according to the results of PCA. SPSS 16.0 tool is used for testing.

1) Reliability Test

Before PCA, reliability test should be carried out to know whether the terms are suitable for PCA. KMO and Bartlett's Test are the best tools for reliability test.As shown in table 1 and table 2, KMO and Bartlett's Test shows that both the terms for testing firm performance and functional flexibility are suitable for PCA.

TABLE I. KMO AND BARTLETT'S TEST FOR FIRM PERFORMANCE

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.572
Bartlett's Test of Sphericity	Approx. Chi-Square	160.819
	df	10
	Sig.	.000

TABLE II. KMO AND BARTLETT'S TEST FOR FUNCTIONAL FLEXIBILITY

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.881
Bartlett's Test of Sphericity	Approx. Chi-Square	725.547
	df	78
	Sig.	.000

2) Factors in Performance

Two factors can be extracted in terms of firm performance and the two factors explain 72.128% of the variables as shown in table 3. The two factors are named cost（F_1） and output(F_2). And integration of them(F_p) can measure firm performance.

After extracted the two factors,Communalities are all above 0.7 which implies that information losed little and factors extracted are perfect.

TABLE III. TOTAL VARIANCE EXPLAINED FOR FIRM PERFORMANCE

Component	**Initial Eigenvalues**		
	Total	***% of Variance***	***Cumulative %***
1	2.196	43.915	43.915
2	1.411	28.213	72.128
3	.708	14.166	86.294
4	.454	9.086	95.380
5	.231	4.620	100.000

To be Continued

Component	**Rotation Sums of Squared Loadings**		
	Total	***% of Variance***	***Cumulative %***
1	2.061	41.228	41.228
2	1.545	30.900	72.128
3			
4			
5			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

TABLE IV. ROTATED COMPONENT MATRIX(A)

	Component	
	1	***2***
Human resource cost（x_1）	-.055	.833
Output per employee(x_2)	.632	.352
Product quality(x_3)	.918	-.058
Product cost(x_4)	.180	.850
Customer Satisfaction(x_5)	.885	.021

The variables are loaded differently in the two factors as seen in table 4.

So the factors are scored as follows.

$$F_1 = -0.055x_1 + 0.632x_2 + 0.918x_3 + 0.18x_4 + 0.885x_5 \quad (1)$$

$$F_2 = 0.833x_1 + 0.352x_2 - 0.058x_3 + 0.85x_4 + 0.021x_5 \quad (2)$$

$$F_p = (0.412F_1 + 0.309F_2)/0.72128 \quad (3)$$

3) Factors in Functional Flexibility

As show in table 5,three distinct sub-dimensions of HR functional flexibility have been identified, namely ,training(F_{f1}), multi-learning(F_{f2}) and self-

determination(F_{f3}). The three dimensions explain 65.837% of the iterms.

TABLE V. TOTAL VARIANCE EXPLAINED FOR FUNCTIONAL FLEXIBILITY

Component	Initial Eigenvalues		
	Total	*% of Variance*	*Cumulative %*
1	6.121	47.085	47.085
2	1.368	10.519	57.604
3	1.070	8.233	65.837
4	.916	7.046	72.883
5	.607	4.667	77.550
6	.581	4.473	82.023
7	.456	3.510	85.533
8	.392	3.017	88.550
9	.375	2.886	91.436
10	.351	2.704	94.140
11	.295	2.271	96.411
12	.280	2.155	98.566
13	.186	1.434	100.000

To be Continued

Component	Rotation Sums of Squared Loadings		
	Total	*% of Variance*	*Cumulative %*
1	3.618	27.831	27.831
2	2.789	21.451	49.282
3	2.152	16.554	65.837

Extraction Method: Principal Component Analysis.

By SPSS tools,Communalities of the three dimensions are all above 0.7 which implies that information losed little and factors extracted are perfect.

Cronbach's Alpha of the three dimensions is 0.830,0.680 and 0.882 respectively. That means the liability is in a high level.

TABLE VI. ROTATED COMPONENT MATRIX(A) FOR FUNCTIONAL FLEXIBILITY

	Component		
	1	*2*	*3*
A1	.228	.370	.589
A2	.417	.661	.193
A33	.172	.831	.114
A4	.685	.394	.179
A5	.051	.736	.387
A6	.660	.268	.370
A7	.345	.756	.123
A8	.794	.232	.091
A9	.724	.177	-.008
A10	.745	.029	.372
A11	.725	.198	.356
A12	.301	.219	.770
A13	.101	.104	.745

Extraction Method: Principal Component Analysis.

$$F_{f1} = 0.228A_1 + 0.417A_2 + 0.172A_3 + +.....0.101A_{13} \quad (4)$$

$$F_{f2} = 0.37A_1 + 0.661A_2 + 0.831A_3 + +.....0.104A_{13} \quad (5)$$

$$F_{f3} = 0.589A_1 + 0.193A_2 + 0.114A_3 + +.....0.745A_{13} \quad (6)$$

$$F_f = (0.28F_{f1} + 0.21F_{f2} + 0.17F_{f3})/0.65837 \quad (7)$$

According to this,scores of functional flexibility can be calculated for each firm.

IV. RESULTS

In all the samples,mean of numerical flexibility is 0.185. Mean of functional flexibility is 3.56.So four mixture models are identified according to mean as mentioned in the second part.

As the categorization shows that 19.2% of firms are involved in HH model, 28.2% involved in HL model, 30.8% involved in LH model and 21.8% involved in LL model.

TABLE VII. FIRM PERFORMANCE IN DIFFERENT MODELS

Mixture Models	F_1	F_2	F_p	Top List
HH Model	10.8	8.1	9.86	2
LH Model	8.6	6.9	7.8999	4
HL Model	11.3	8.6	9.9099	1
LL Model	9.4	7.3	8.46	3

According to the method mentioned above, two factors of firm performance and integrated index are scored as seen in table 7.

It is showed that cost (F1) is high in HL model and HH model. Output(F2) is also high in HL model and HH model. HL model performs a little higher than HH model.Firms with high fuctional flexibility all perform high than firms with low functional flexibility.Firms in LH model perform the lowest in the four models.

V. CONCLUSIONS

How does HR flexibility contribute to firm performance has been attracted increasing attentions in recent years.This paper contributes to study firm performance by different mixture models of HR flexibility.

As demonstrated, functional flexibility contributes much more in firm performance and numerical contributes much less for firm performance.Firms in HL model perform best in the foure models.So there is some benefits for firms to mix functional flexibility and numerical flexibility.

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