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Evidence from China's A-Share Market

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Does Internal Control Quality improve Earnings Persistence? Evidence from China's A-Share Market

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Highlights

- We examine whether the improvement of internal control quality can enhance the earnings persistence after mandatory disclosure of internal control self-evaluation and internal control audit in China's listed companies. We aim to see the economic effect of this policy.
- For a more detailed analysis, we first divide the accounting earnings into cash flows and accruals, then we group the whole sample by ownership structure —— SOEs and Non-SOEs.
- We build the internal control quality comprehensive index from the view of external investors. So only the internal control quality data which can be obtained from public is chosen in our modeling.
- Not surprisingly, the impact of internal control quality on accruals persistence is stronger than that on cash flows persistence. Investors believe that comparing with cash flows, accruals is easier to be manipulated by management. So, higher internal control quality can better improve accounting estimates accuracy and enhance the accruals persistence.
- What surprising us is that the improvement of internal control quality makes accruals for SOEs more sustainable, and makes cash flows more persistence for non-SOEs.

1. Introduction

In recent years, earnings of Chinese listed companies encountered significant fluctuation. The unreliability of current earnings led to a low earnings persistence. Among many factors that contributed to the turnaround in corporate performance, a key factor that for example had occurred in Enron and WorldCom, repeatedly happened in China's listed companies —— the failure of internal control. Hence, China's Ministry of Finance issued the Chinese "Sarbanes-Oxley Act" – the Basic Norms for Internal Control of Enterprises (BNICE) in 2008, which made it mandatory for listed companies to disclose their internal control self-evaluation reports as well as financial and internal control audit reports since 2012.

The United States and Japan have implemented similar policies regarding mandatory internal control audits. However, despite the desirable intention to enhance the effectiveness of internal control, this policy undoubtedly increased many companies' costs. This is a major reason why other countries remain hesitant to implement similar policies.

Therefore, a topic worth investigating is whether this mandatory disclosure achieves the government's goals of strengthening the current earnings quality and enhancing the earnings persistence.

There has been a debate on the positive correlation between internal control and earnings in academia. The majority of researchers found that defects of internal control quality cause operational problems of an enterprise (Ashbaugh-Skaife et al., 2008). In turn, high quality of internal control has been shown to have the potential to effectively reduce managers' manipulation of profits and prevent them from damaging the enterprises by pursuing their own interests (Hazarika et al., 2012).

Furthermore, the operation and financial reporting of the enterprises have been found to affect its earnings persistence. Improving a company's internal control quality resulted in a stronger persistence of earnings not only because of the significant positive role in promoting the current earnings level, but also by enabling a more accurate prediction of future earnings, (Doyle, 2007 and Freeman, 1992). Furthermore, operating profit and dividends were shown to be lower for companies with a lesser internal control quality (Krishnan and Yu, 2012). Listed companies, performing internal control audits exhibit a higher quality of earnings than companies that do not in engage in such audits (Krishnan and Yu, 2012).

Some researchers however identified that too many executives would carry out radical earnings management and manipulation, thus reducing the earnings reliability (Hazarika et al., 2012). In addition, an empirical study using data from before the BNICE implementation in 2008 did not show that improvement of internal control quality promoted earnings quality (Zhang, 2008).

This paper investigates whether the improvement of internal control quality can effectively enhance the correlation between current earnings and future earnings after the disclosure of internal control reports became mandatory for Chinese listed companies in 2012. If the empirical research finds a positive correlation, it can be assumed that internal control can function as a regulator of current earnings and help investors determine the company's value more accurately.

2. Research Hypothesis

The most important factor in earnings persistence is the error of accounting estimation (Liu, 2014). It does not matter whether accounting estimation errors arise from managers' intentions to promote their own interest or their judgment errors, or whether they arise from non-subjective errors caused by the negligence or lack of ability of the management and accountants, either way they cannot be prevented under the accrual system, unless an internal control system is implemented. The implementation of internal control therefore functions as a control for a company's production, operation and investment. It can strengthen the supervision and control ability of enterprise management and ensure a high sustainable surplus (Xiao and Zhang, 2013). Therefore, we propose:

Hypothesis 1: Companies with higher internal control quality have higher earnings persistence.

According to accounting measurement, accounting earnings can be divided into two parts: cash flows and accruals. Accruals, cash flows and ownership structure, along with some other factors, are found to affect earnings persistence (Sloan, 1996 and Dichev and Tang, 2009). Hence, accrual and cash flow persistence are seen as a concrete measure for earnings persistence. These two parts do not have the same influence on the earnings continuity for the next period (Scott, 2015), as the accruals persistence is positively directly correlated with the internal control quality (Doyle et al., 2007). However, high quality internal control can indirectly reduce the manipulation of cash flows by restraining earnings management such as excessive raw material purchase and abnormal advertising expenses. Based on this, the following hypothesis is put forward:

Hypothesis 2: The impact of internal control quality on the accrual persistence is stronger than on the cash flows.

Tessema et al. (2018) used data from Korean companies to confirm that listed companies with government shares which pay more attention to the internal control are superior to family-owned companies regarding the reliability and transparency of earnings reports. Similarly, Chinese state-owned enterprises (SOEs) are expected to not only maximize their shareholders value, but are also subject to more government supervision.

Men and Luo (2014) also found large differences between different ownership structures (SOEs and Non-SOEs) in the process of disclosing internal control information, confirming accruals and cash flow persistence. So, we further put forward:

Hypothesis 3: Under the condition that other factors remain unchanged, correlation between the internal control quality and earnings persistence of SOEs is stronger than that of non-SOEs.

3. Data and models

3.1 Data source and sample selection

The sample selection process is as follows: (1) Eliminate companies listed later than 2013 and samples with missing values; (2) Eliminate companies in financial industries; (3) Tail treatment of the top and bottom 1% of observations of the main variables. Finally, a panel data set of 1958 listed companies from 2013-2018 in China A-share stock market was obtained.

3.2 Measurement of main variables

Many researchers built a comprehensive internal control index based on the five elements of internal control (Chen, 2017). However, a lot of specific internal company data is difficult to obtain for external investors. Consequently, we only select the indicators that can be obtained by investors, which we score and sum up to establish the comprehensive internal control quality index (EIC) as shown in Table 3.1.

Table 3.1 Measurement method of internal control quality

Explanation Variable	Variable Definition and Measurement Metric
	Disclosure of internal control self-evaluation report: 1 for disclosure, 0 for otherwise
	Audit firm's opinion to internal control: Take 1 for unqualified opinion, otherwise take 0
	Disclosure of internal control defects: 1 for disclosure, 0 for otherwise
	Whether to change after the annual report is published: 0 for change, otherwise 1
	Whether to change after the annual report is published: 0 for change, otherwise 1
	Whether the annual report data is wrong: take 0 in error, otherwise 1
	Whether to receive punishment from CSRC or Stock Exchange: 0 if any, 1 if not
EIC	Sum of the above
ZEIC	Internal control quality, Z-Score standard value of EIC

In this paper the earnings persistence is reflected by the regression coefficient between current earnings and next period earnings. Thereby, the value of the coefficient indicates the

persistence. The impact of internal control on earnings persistence is measured by a cross term coefficient in the model. The higher the internal control quality, the greater the impact on earnings persistence.

The applied control variables are: company's growth opportunities, asset-liability ratio, company's size, annual, industry and ownership structure. The specific description can be found in Table 3.2.

Table 3.2 Variables Definition

Variable type	Variable code	Variable name
Dependent Variable	Earnings _{t+1}	The next period net income.
Independent Variables	ZEIC	Internal control quality
	Earnings _t	The current net income
	CFO	Cash flows
	ACC	Accruals
Control Variables	Growth	Company's growth rate
	Lev	Leverage
	Size	Company's Size
	Y	Year
	Ind	Industry classification
	SOE	Ownership structure

3.3 Modeling

Model 1 and 2 represent the basic regression models which reflect the persistence of earnings between current earnings and next period earnings.

$$Earnings_{i,t+1} = \alpha_0 + \alpha_1 \times Earnings_{i,t} + \sum \alpha_i \times Control + \mu_{i,t} \quad (1)$$

$$Earnings_{i,t+1} = \beta_0 + \beta_1 \times ACC_{i,t} + \beta_2 \times CFO_{i,t} + \sum \beta_i \times Control + \mu_{i,t} \quad (2)$$

Model 3 and 4 add the cross term of internal control quality with current earnings, accruals or cash flows to the models above, respectively.

$$Earnings_{i,t+1} = \alpha_0 + \alpha_1 \times Earnings_{i,t} + \alpha_2 \times ZEIC \times Earnings_{i,t} + \sum \alpha_i \times Control + \mu_{i,t} \quad (3)$$

$$Earnings_{i,t+1} = \beta_0 + \beta_1 \times ACC_{i,t} + \beta_2 \times CFO_{i,t} + \beta_3 \times ZEIC_{i,t} \times ACC_{i,t} + \beta_4 \times ZEIC_{i,t} \times CFO_{i,t} + \sum \beta_i \times Control + \mu_{i,t}$$

(4)

If H1 holds, the value of α_1 in Model 3 should be greater than that in Model 1, and α_2 (coefficient of $ZEIC \times Earnings_{i,t}$) should be significant and positive. If H2 holds, β_3

(coefficient of $ZEIC \times ACC_{i,t}$) and β_4 (coefficient of $ZEIC \times CFO_{i,t}$) should be significant and positive, and $\beta_3 > \beta_4$. Next, looking at the two sub-samples — SOE and non-SOE, if H3 is true, α_2 , β_3 and β_4 of SOEs should be greater than the corresponding values of non-SOEs.

4. Empirical test

4.1 Descriptive statistical analysis

The mean of EIC during 2013-2017 are 4.76, 4.83, 4.81, 4.67 and 4.96 respectively. Table 4.1 shows that there are large differences in the number of observations for each EIC score. Therefore, we further divide internal control quality into two groups: $1 \leq EIC \leq 4$ is the low-quality group, $5 \leq EIC \leq 6$ is the high-quality.

Table 4.1 Statistics of EIC during 2013-2017

EIC	1	2	3	4	5	6	Total
Sample size	7	116	1007	746	6891	1023	9790

The results of the mean difference test of the main variables, depicted in Table 4.2, show that next period's earnings, cash flows and accruals significantly differ between the low-quality and high-quality group. This preliminarily supports H1. The mean difference test in Table 4.3 shows that the internal control quality of SOE is significantly higher than non-SOE, but the earnings and their composing parts are significantly lower for SOEs. This means that interactions between internal control and earnings should be considered in the regression.

Table 4.2 Descriptive statistics between groups - internal control quality group

Variables	Low (1876)		High (7914)		Low V.S. High
	Mean	Std.Dev	Mean	Std.Dev	Mean Test
ZEIC	-1.787	0.743	0.424	0.412	-1.7e+02***
Earnings _{t+1}	0.046	0.088	0.056	0.119	-3.423***
Earnings _t	0.045	0.241	0.046	0.095	0.428
CFO	0.041	0.091	0.047	0.078	-2.901***
ACC	0.003	0.259	-0.001	0.114	1.153*

***, **, and * indicate significant at 1%, 5%, and 10% level respectively.

Table 4.3 Descriptive statistics between groups – by Ownership structure

Variable	SOE(3950)		Non-SOE(5840)		SOE V.S. Non-SOE
	Mean	Std.Dev	Mean	Std.Dev	Mean Test
ZEIC	0.070	0.016	-0.048	0.013	-5.738***
Earnings _{t+1}	0.043	0.001	0.061	0.002	7.940***
Earnings _t	0.037	0.001	0.052	0.002	5.530***
CFO	0.046	0.001	0.046	0.001	0.131
ACC	-0.009	0.001	0.006	0.002	4.815***

***, **, and * indicate significant at 1%, 5%, and 10% level respectively.

4.2 Correlation test

The results of the Pearson correlation analysis are depicted in Table 4.4. The correlation coefficient between internal control quality and the next period earnings is 0.029. It shows that internal control quality positively correlates with the next period earnings, which can be seen as an indicator that H1 might be true. However, there is no significant positive correlation between internal control quality and current earnings. Although, internal control quality is highly positively correlated with cash flows, its correlation with accruals is negative. In Table 4.5 only the internal control quality of non-SOEs has a significant positive correlation with next period earnings. Therefore, an interaction term between internal control, current earnings and its components should be added to the regression.

Table 4.4 Correlation analysis of the total sample

Variables	Earnings _{t+1}	Earnings _t	ZEIC	CFO	ACC
Earnings _{t+1}	1				
Earnings _t	0.187***	1			
ZEIC	0.029***	-0.006	1		
CFO	0.203***	0.064***	0.026***	1	
ACC	0.058***	0.85***	-0.019*	-0.472***	1

***, **, and * indicate significant at 1%, 5%, and 10% level respectively.

Table 4.5 Correlation analysis by ownership structure

Variables	Earning _{t+1}	Earning _t	ZEIC	CFO	ACC
Earning _{t+1}	1	0.157***	0.053***	0.199***	0.055***
Earning _t	0.479***	1	-0.004	0.056***	0.894***
ZEIC	-0.017	0.0003	1	0.036***	-0.02
CFO	0.258***	0.141***	0.011	1	-0.397***
ACC	0.049***	0.46***	-0.01	-0.414***	1

Notes: (1) The lower left corner shows the correlation coefficients of the SOE, and the upper right corner shows the correlation coefficients of the non-SOE.

(2) ***, **, and * indicate significant at 1%, 5%, and 10% level respectively.

4.3 Multiple regression analysis

4.3.1 Regression of the overall sample

Table 4.6 shows that the F-values of the four models have passed the significance test at a 1% level, wherefore we can conclude that the model settings are reasonable. Moreover, the Adj_R² of Models 3/4 is larger than Models 1/2, which indicates that the regression's goodness of fit is improved by adding the internal control quality factor.

Table 4.6 Comparison of regression model results

	Model 1	Model 2	Model 3	Model 4
Earnings _t	0.1371*** (16.55)		0.2665*** (23.58)	
ACC		0.1305*** (15.98)		0.2563*** (22.64)
CFO		0.3774*** (23.69)		0.4821*** (28.21)
ZEIC*Earnings _t			0.1073*** (16.58)	
ZEIC*ACC				0.1027*** (15.82)
ZEIC*CFO				0.0622*** (5.01)
Lev	-0.0008*** (-11.67)	-0.0006*** (-8.87)	-0.0006*** (-8.74)	-0.0004*** (-6.38)
Growth	0.0002*** (7.32)	0.0002*** (7.54)	0.0002*** (6.45)	0.0002*** (6.54)
Size	0.0011** (1.01)	-0.0013 (-1.20)	-0.0003 (-0.3)	-0.0023** (-2.19)
Constant term	0.0581** (2.40)	0.0885*** (3.71)	0.0763** (3.19)	0.1006*** (4.26)
Adj_R ²	0.0667	0.0952	0.0922	0.1177
F Value	31.44***	43.92***	42.42***	51.23***

***, **, and * indicate significant at 1%, 5%, and 10% level respectively. T value is in the brackets.

According to Model 1, the marginal impact of current earnings on next period's earnings is 0.1371. However, with the addition of internal control quality factors, in Model 3 an increase in the marginal impact of current earnings by 0.1294 can be observed. In addition, it also shows that when the internal control quality of a company exceeds the

average level, the forecast of current earnings to next period's earnings will increase by 0.1073 units for each unit increase in internal control quality. It can be seen that internal control plays a correction role in the earnings persistence. Comparing the values for the model fit of Models 2 and 4, we get the same result. Therefore, we can verify Hypothesis 1.

In Model 4, with an increase in internal control quality, accruals exhibit a 0.0405 units higher marginal increase in the next period's earnings than the cash flows. This shows that the correction effect of internal control quality on accruals is stronger than that on cash flows. Consequently, accruals persistence is stronger than cash flow persistence and Hypothesis 2 is verified.

4.3.2 Regression by internal control quality

Table 4.7 shows the regression results of the low-quality and high-quality group of internal control. The F-values of all models are significant at a 1% level, so the classifications of the models are reasonable. All the regression coefficients of the two groups were significant.

For model 1 and 2, the coefficients of explanatory variables in the high-quality group were higher than those in the low-quality group. The higher the internal control quality is, the stronger the persistence of current earnings, accruals and cash flows. Since $ZEIC < 0$ in the low-quality group, the marginal future earnings rate of current earnings in model 3 is $0.3023 + 0.1238 * ZEIC < 0.3023$, which is adjusted downward according to the internal control quality. As $ZEIC > 0$ in the high-quality group, the marginal future earnings rate of current earnings is $0.2387 + 0.2008 * ZEIC > 0.2387$, which is adjusted upward according to the internal control quality. Above evidence shows that the higher the internal control quality, the stronger the persistence of current earnings. This further verifies Hypothesis 1.

Table 4.7 Comparison of regression results grouped by internal control quality

Dependent variable (Earning _{t+1})	Low-Quality Group (EIC=1/2/3/4)			
	Model 1	2	3	4
Earning _t	0.0374*** (4.58)		0.3023*** (5.52)	
ACC		0.0395*** (5.04)		0.3303*** (6.24)
CFO		0.3104***		0.5525***

		(13.52)		(8.40)
ZEIC*Earning _t			0.1238***	
			(4.89)	
ZEIC*ACC				0.1358***
				(5.56)
ZEIC*CFO				0.1042***
				(3.25)
Lev	-0.0008***	-0.0006***	-0.0008***	-0.0006***
	(-7.00)	(-5.39)	(-6.75)	(-5.08)
Growth	0.0003***	0.0003***	0.0004***	0.0003***
	(6.27)	(6.18)	(6.20)	(6.08)
Size	0.0033*	0.0008	0.0032*	0.0008
	(1.77)	(0.42)	(1.73)	(0.44)
Constant term	0.0300	0.0602	0.0282	0.0544
	(0.72)	(1.50)	(0.68)	(1.36)
Industry	Control	Control	Control	Control
Year	Control	Control	Control	Control
Adj_R ²	0.0776	0.1506	0.0889	0.1638
F Value	7.86***	14.85***	8.62***	15.13***

Dependent variable(Earning _{t+1})	High-quality Group (EIC=5/6)			
	Model 1	2	3	4
Earning _t	0.3003***		0.2387***	
	(21.58)		(12.20)	
ACC		0.2824***		0.2052***
		(20.40)		(9.72)
CFO		0.4991***		0.4727***
		(24.10)		(17.79)
ZEIC*Earning _t			0.2008***	
			(4.48)	
ZEIC*ACC				0.2582***
				(4.86)
ZEIC*CFO				0.1207***
				(2.63)
Lev	-0.0006***	-0.0004***	-0.0006***	-0.0004***
	(-7.14)	(-5.24)	(-6.76)	(-4.70)
Growth	0.0002***	0.0002***	0.0002***	0.0002***
	(4.49)	(4.82)	(4.35)	(4.50)
Size	-0.0010	-0.0030**	-0.0012	-0.0032
	(0.85)	(-2.42)	(-1.01)	(-2.59)
Constant term	0.0846	0.1102***	0.0865	0.1118

	(3.00)	(3.94)	(3.07)	(4.01)
Industry	Control	Control	Control	Control
Year	Control	Control	Control	Control
Adj_R ²	0.0922	0.1107	0.0944	0.1132
F Value	35.94***	42.04***	35.36***	39.86***

***, **, and * indicate significant at 1%, 5%, and 10% level respectively.

In the low-quality group, the marginal future earnings rate on accruals corresponding to the improvement of internal control quality is 0.0316 units higher than the marginal future rate of return on cash flows. Meanwhile, in the high-quality group, the marginal future earnings rate on the accruals increased to 0.2582 units under the influence of internal control quality, exceeding the marginal future earnings rate on cash flows by 0.1375 units. Therefore, investors believe that higher quality internal control can prevent the abuse of accruals. Hence accruals have a more reliable impact on the prediction of future earnings. This further validates Hypothesis 2.

4.3.3 Regression by ownership structure

Table 4.8 shows that the regression models of SOEs have significantly higher F-values and Adj_R² than those of non-SOEs. This shows that under SOEs the models' goodness of fit is far higher, wherefore the models' explanatory power is stronger.

Table 4.8 Comparison of regression results by ownership structure

Model	SOE		Non-SOE	
	3	4	3	4
Earnings _t	0.5297*** (27.57)		0.2409*** (16.66)	
ZEIC* Earnings _t	0.0861*** (6.05)		0.0996*** (12.15)	
ACC		0.5354*** (27.46)		0.2285*** (15.85)
CFO		0.6643*** (30.82)		0.4974*** (20.29)
ZEIC*ACC		0.0987*** (6.40)		0.0940*** (11.51)
ZEIC*CFO		0.0434** (2.97)		0.0557** (2.99)
Lev	-0.0005*** (-9.06)	-0.0004*** (-7.20)	-0.0005*** (-4.14)	-0.0003** (-2.40)
Growth	0.0002*** (6.33)	0.0002*** (5.97)	0.0002** (3.44)	0.0002*** (3.69)

Size	0.0023*** (3.05)	0.0010 (1.42)	-0.0012 (-0.63)	-0.0038* (-1.94)
Constant term	-0.0079 (-0.46)	0.0081 (0.48)	0.1164** (2.67)	0.1451** (3.37)
Year	Control	Control	Control	Control
Industry	Control	Control	Control	Control
F Value	63.52***	67.56***	22.90***	28.28***
Adj R ²	0.2669	0.2964	0.0826	0.1083

***, **, and * indicate significant at 1%, 5%, and 10% level respectively.

With the improvement of internal control quality, the marginal future earnings on current earnings of SOEs (0.0861) is slightly lower than that of non-SOEs (0.0996). In Model 4 the earnings are decomposed into accruals and cash flows. We found that marginal future earnings on the accruals of SOEs (0.5354) is significantly superior to the corresponding value of non-SOEs (0.2285), and its marginal future earnings of cash flows (0.0434) is slightly lower than the marginal effect on cash flows of non-SOEs (0.0557).

It can be seen from the existing evidence that internal control quality has a stronger correlation with the accruals persistence of SOEs than that of non-SOEs. Hypothesis 3 has thus been partially verified.

4.4 Robustness test

In order to ensure the robustness of the research results, a robustness test based on the definition of variables has been executed. Although net income is an important indicator to the investors, it includes the impact of non-recurring profit and loss items. The more important and objective accounting index for the realization of business objectives is the operating profit, so the operating profit is used as the value of earnings in the robustness test. After conducting the regressions of models 1-4 again, we still found that the regression coefficients of high-quality internal control with earnings accruals and cash flow interaction are significantly positive. This proves the robustness of the results. (results not shown).

5. Conclusion

As mandatory disclosure of internal control will significantly increase enterprises' costs, the EU, Canada, the UK and other countries appear to be undecided as to whether the benefits outweigh the costs. Listing rules in the UK only require auditors to formally

review internal control claims made by management. Using a sample of Chinese listed companies, this paper finds that internal control quality has a great positive marginal effect on earnings, accruals and cash flows. Hence, it can significantly enhance earnings and its components' persistence after mandatory disclosure of internal control self-evaluation and internal control audit report. This paper provides strong proof that investors can more effectively evaluate the current earnings persistence by distinguishing the internal control quality.

Many Chinese listed companies, such as Xintai Electric and Kangmei Pharmaceutical were in recent years exposed to have manipulated accruals to create fictitious income and assets. Through the cross-term analysis, we know that the influence of internal control quality corresponding to accruals persistence is far greater than that of cash flow persistence. Therefore, based on the internal control information disclosed by the company, investors can more reliably assess the persistence of the disclosed accrual data and judge whether the company's future earnings will suddenly change.

We also found that the improvement of internal control quality makes accruals of SOEs more sustainable and cash flows of non-SOEs more persistent. High-quality internal control can effectively restrain SOEs' management from excessive "bad" earnings management, while reducing the frequency of non-SOEs major shareholders' encroachment on minority shareholders' equity through occupying funds. Therefore, investors can consider internal control quality as a control mechanism to adjust the current earnings.

Author statement

Gongyuan Gong

I have communicated with Dr. YAN and Dr. YANG about this topic quite a long time before we started this paper. I have written the literature review and theoretical analysis of Hypothesis 3. And I have made substantial contributions to the acquisition, modeling analysis, and regression interpretation of data in this paper. And I have helped modeling and drafting the work. And I revised it critically for important intellectual content. I agree to be accountable for all aspects of the work in ensuring that questions

related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Nianxiang YANG

This is an interesting topic. I have made substantial contributions to the conception or design of the work with Dr. Gong and Dr. Yan. I have written the theoretical analysis of Hypothesis 1 and Hypothesis 2. And I have helped collecting the data which must be done by hand work. And I Participated in the revision of this paper.

I agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Yongjun YAN

This is an interesting topic. I have made substantial contributions to the conception or design of the work with Dr. Gong and Dr. YANG. I have written the literature review of Hypothesis 1 and Hypothesis 2. And I have helped modeling and drafting the work. And I reviewed the revised version of this paper.

I agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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