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Contents

Dimensions of Perceived Risk and Their Influence on Consumers' Purchasing Behavior in the Overall Process of B2C	1
<i>Lingying Zhang, Wojie Tan, Yingcong Xu, Genlue Tan</i>	
Research on the Mode Selection of Technology Transfer and Innovative Process	11
<i>Jianxin Zhang, Shudong Sun</i>	
ARCH Model Approach to Measuring Function of Government in the Science & Technology Auto-organization System	15
<i>Neng Shen</i>	
Research on New Patterns of Fostering the Innovative Ability in China's Graduate Education	21
<i>Wang Peizhi, Liu Jun</i>	
Social Network's Impact on New Venture Performance—An Empirical Research of Zhejiang Entrepreneurs	27
<i>Jun-ping Yang, Lu-bin Tang, Zhe-jing Lu</i>	
Cluster Analysis of Regional Economic Development in Hebei Province	35
<i>Dongchu Cui, Yue Yu, Zhijie Song</i>	
Research on Construction of University Students' Self-regulated Learning Environmental Based on Internet	41
<i>Sun Dao-yin, Zhang Xin-rui</i>	
Research on Contracting Risk Control in Building Engineering	47
<i>Guo Zhanglin, Shi Ying</i>	

Model of Biding Evaluation Based on Algorithm of Adjusting Weight of Decision-Makers	53
<i>Xin Yang, Mei Lu</i>	
The Training Program for Product Design Engineers of Automotive Industry in China	63
<i>Yinghua Fu, Yiquan Zhao, Yue Li</i>	
A Multi-agent Economic Simulation System	69
<i>Wu Li</i>	
A Bi-level Programming Model for a Multi-facility Location-Routing Problem in Urban Emergency System	75
<i>Sun Hua-li, Wang Xun-qing, Xue Yao-feng</i>	
The Comparative Study of the Effect of Incentives and Punishments in the Corporation	81
<i>Guoqin Bu</i>	
The CDIO Teaching Practice of Mechanism Analysis and Design	87
<i>Jiang Fan, Zhang Chunliang, Wang Yijun</i>	
The Creation and Connotation of Seven Equations in “A+T·CDIO” Engineering Teaching Reform	93
<i>Liu Chaoying</i>	
The Study on Constructing the Teaching System of the Generic Cabling Course for the Intelligent Building Major	99
<i>Jianwen Cao, Xinli Wei</i>	
Multimedia Technology Applied to College Ideological and Political Theory Course Teaching Problems and Countermeasures	107
<i>Qiu Shuangcheng</i>	
Strategic Study of Improvement of Regional College Graduates’ Employability	113
<i>Ke Ming Xu, Bi Xia Lin</i>	
Application of Sports-Based Project Teaching Mode in Cultural Education for Athletes	119
<i>Wei Chen, Mei Yang</i>	
The Teaching Reform of the Course of Quality Management and Reliability	125
<i>Li Li Meng, Hui Zhen Zhao, Chun Guang Lu, Lin Chen</i>	
Discussion on Classroom Teaching to Improve Specialized English Ability of Engineering Students	131
<i>Quanli Han, Wenming Zhang, Xuhui Zhang</i>	

Exploration and Analyzing of Bilingual Teaching in “Engineering Graphics” in College	137
<i>Xiaoyan Xi, Ziqin Li, Lili Meng, Huigang Wang</i>	
An Analysis on the Differences between the Specialty-Education of Sino-American Construction Engineering Management	143
<i>Kang Xiangping</i>	
An Exploration of Curriculum Construction in Higher Vocational Education with a Working and Learning Combination Pattern	149
<i>Guang Si Luo</i>	
Research on Constructing Index System of Talents Evaluation for Science and Technology Enterprises	157
<i>Li Yun Xing, Zhao Tong Zhu</i>	
Study on the Innovative Education in Geometric Tolerance	165
<i>Yu Li, Chong Yang Zhao, Jun Jin Ma, Ping Yan Bian</i>	
Analysis on Teaching in Course of “Architecture Structure” of Engineering Management Major	171
<i>Suqing Cao, Xiaofei Xin</i>	
Focus on Form Instruction—Theoretical Review of Research Abroad	175
<i>Hongju Yan</i>	
Background and Introspection of Higher Vocational Education Reforms in China	181
<i>Zhenhua Liu</i>	
Searching a “Work-Integrated Learning” Teaching Practice for the Mould Professional Course	187
<i>Jiaju An, Zhaorong Su</i>	
Feasibility Study on the Talent Cultivation Mode of “Work-Integrated Learning”	193
<i>Zhaorong Su, Jiaju An</i>	
Risk Measurement of Rail Transit Investment and Financing	199
<i>Ji Fa Wang, Wei Li</i>	
Cultivating Innovative Applied Talents by Constructing the Specialized Core Curriculum System	205
<i>Shouming Hou, Fen Luo, Wenpeng Xu</i>	
Research of Education about Industrial Design Based on the Modern Engineering Design Software	211
<i>Ming-qian Shen, Jiang-tao Wang</i>	

Conceive and Construction of Engineering Training Model Based on the Concept of International CDIO Engineering Education	219
<i>Shuli Sun, Yangfang Wu, Qianqian Lu, Hua Liu, Wei Shao</i>	
Adding Value: Strengthening the Relationship among “Teaching”, “Learning” and “Researching” in Undergraduate Engineering Education	225
<i>Hao-Yu Shen</i>	
Exploration and Practice of Basic Computer Teaching Reform under New Situation for Colleges	231
<i>Zhiguo He, Li Yan</i>	
Overall Course Design Method Based on Working Process— Illustrated by the Course of <i>Mechanical Components Design</i>	243
<i>Jin-mei Zhang, Hong-jin Bai, Chong-you Feng</i>	
Efficiency Frontier for Chinese Stock Markets under Influence of Financial Crises	251
<i>Wang An Guo</i>	
English-Chinese Bilingual Lectures on Hydraulic and Pneumatic Transmission and Engineering Education	261
<i>Shumei Chen, Chuanming Chen, Shuncong Zhong</i>	
Evaluation and Analysis on Benefit of Chinese College Resources Input	267
<i>Zhu Xiao-hong</i>	
Investigation of the Connotation and Constitution Elements of Innovative Practice Ability	273
<i>Rangtong Liu, Chao Zhang, Fenghua Liu, Peixue Wang</i>	
“1234 Project Design Curriculum Innovation Model” for Local Engineering Colleges on the Basis of “Excellence Plan”	279
<i>Liu Chaoying</i>	
Research on Practice Teaching of Engineering Education in Co-op Mode	285
<i>Tao Guo, Xuefei Li, Yanfang Li</i>	
Creative Talents Training Pattern of Telecommunication Engineering in Colleges	289
<i>Geng Li, Yu-na Su</i>	
Research on the Performance Incentive Methods of Higher Education	295
<i>Zhi Ping Du, Yu Zhang, Le Shi Cai</i>	

Study on Innovative Training System in Local University Based on TRIZ Theory	301
<i>Jiang Fan, Zhang Chunliang, Xiao Zhongmin</i>	
Research and Practice of Entrepreneurship Education Reform: The Case of Wenzhou University	309
<i>Er Lei Zeng</i>	
Formation Strategies of Innovative Practice Ability Based on Its Constitution Elements	315
<i>Rangtong Liu, Chao Zhang, Fenghua Liu, Peixue Wang</i>	
Investigation and Analysis on Humanistic Quality Education of Science and Engineering University in China	321
<i>Hong Xia Chen</i>	
Exploration on the Reform of Mechanical Engineering Graduates' Quality Education	327
<i>Wei Li, Xiaoyan Cao</i>	
Hydropower-Based Research on Training Mode of Civil Engineering ...	333
<i>Ruihong Wang, Jianlin Li, Yuzhou Jiang, Yu Wang</i>	
Construction for the Online Education Evaluation System of Adult Higher Education	339
<i>Chen Juan</i>	
Overview of Service Orientation in Manufacturing Companies	345
<i>Meng Xiang Li, Zhi Yang</i>	
Characteristics and Trends about China's Trade on Internet	353
<i>Yong Ju Ren</i>	
The Application in the Game PBL Teaching	359
<i>Ya Nan Li, Hao Zhang, Jing Zhang</i>	
The Study of Practical Teaching for Undergraduates Majored in Marketing	365
<i>Li Yan Du</i>	
Engineering Graphics Implementation and Reflection on Teaching Quality Assurance	371
<i>Min Xue Luo</i>	
A Study on the of Application Blended Learning Theory in Practical Teaching of Program Design	377
<i>He Yupeng</i>	

A Research on the Humanity Qualities of University Teachers	383
<i>Naisheng Wang</i>	
Study on Effective Assessment of Practical Teaching in University Based on IPA	391
<i>Zhengguo Zhu, Taoxing Zhu, Yongquan Zhu, Minglei Sun</i>	
Job Burnout of University Administrators and Teachers and Its Protective Factors	399
<i>Li Yibai, Zhu Haoliang</i>	
Design of Mechanical Engineering Project Courses Based on Complex Project Carrier	407
<i>Shu Zheng, Wei Jin, Chang Ming Lu, Xiao Rong, Xue Lian Du</i>	
University Culture of Innovation Promote the Healthy Development of University Education	413
<i>Qing Zhu Hu</i>	
Construction of Talent Training Scheme Based on Innovative Practice Ability	419
<i>Rangtong Liu, Chao Zhang, Fenghua Liu, Peixue Wang</i>	
On the Plight and the Solving Way of Higher Engineering Education . . .	425
<i>Hui Wang</i>	
Concerning Clothing Design and Engineering Professional Education Reform	433
<i>Hu QingHong, Jiang Yu, Gong Ke</i>	
In JiLin Province Native Products Brand Design Thinking	437
<i>Gong Ke, Zhen Zhu</i>	
On the Status and Significance of Education on Engineering Ethics in Engineering Education	441
<i>Wenping Wang</i>	
Training Innovative Quality in Engineering Education by the ‘Incomplete’ Study	447
<i>Chi Jun, Guo Jianliang, Zhang Weiwei</i>	
Integrated Reform Research and Practice on Engineering Machinery Course	453
<i>Shuang Chen</i>	
Innovative Research on Graduate Education Quality	457
<i>Qi Ye, Jun Zhang</i>	

Personnel Training Mode Renovation on the Tertiary Vocational Education and Training	461
<i>Kunhong Li</i>	
The Whole Discrete Actuarial Model of Life Insurance with the Interest Rate Obeying Uniform Distribution	467
<i>Nian Nian Jia, Qing Fang Wu</i>	
Research on Physical Education Reform from the Perspective of Physical Fitness	473
<i>Pengtao Lu, Linsen Song, Shibin Wang</i>	
The Exploration of Sino-German Cooperation Training Mode for Electrical Engineering Education	479
<i>Zou Xuan, Shen Jianqiang, Bai Te</i>	
The Applications of Web3D Technologies in Web Teaching of Engineering Graphics	485
<i>Qu Chang, Wang Junze</i>	
Keystone of Engineering Education—Ethics Education	493
<i>Hongju Yan</i>	
Problems and Countermeasures of “Village to Neighborhood” by the Process of Accelerating Urbanization	499
<i>Yuehua Song, Yuanyuan Gu</i>	
The Research of Theory Education and Practice in University Career Planning	505
<i>Tao Zhang, Baojian Shao</i>	
The Discussed of the Role of Mathematics Modeling in the University Mathematics Education	511
<i>Liu Lin, Chang Juan</i>	
Application of PBL Teaching Mode in College Practical Teaching under New Educational Values	517
<i>Hai-ling Sun</i>	
Employment of College Students Research Based on Long Tail Theory	523
<i>Ying Peng, Yinxia Wei</i>	
Preliminary Study on the Ethical Issues of Engineering Activities	531
<i>Wang Jing</i>	

Research on the Human Resource Development of Rural Women—Take the Example of the Rural Women in Shuangliu County of Chengdu	537
<i>Jia Zhang, Qianming Chen</i>	
Promoting Blended Learning Strategies Based on the Participatory Instructional Design Concept	543
<i>Jilan Sun, Yuehong Sun</i>	
Empirical Study of Investment Performance Based on Monthly Holding Period: The Evidence from Listed Banks in Shanghai Stock Exchange	549
<i>Fengjun Liu, Benzhi Shi, Zhu He, Fei Li</i>	
Developing Marine-Related Specialities of Higher Vocational College for Serving the Modern Marine Industries	557
<i>Zhi Yuan Xie, Xue Ren</i>	
<i>Mechanical Principle</i> Teaching and Engineering Ability Training	563
<i>Dongjie Zhao, Hongliang Guo, Zhenhua Qi</i>	
Exploration on Cultivating Integration Capabilities of Polymer Talents	569
<i>Dongjian Shi, Mingqing Chen, Xiaoya Liu, Weifu Dong</i>	
Application of Eight Engineering Education Management Principles in the Application—Oriented Talents Training	575
<i>Lixin Yin, Jing Yan, Guowen Li</i>	
Study on the Design and Implementation of Economics Experiment—Take Demand Curve as an Example	581
<i>Jun Xian Liu</i>	
Construction of Digital Learning Platform for Ocean Universities' Advanced Mathematics	585
<i>Zhang Ming, Gao Shengzhe, Qu Leilei</i>	
Lecture Notes in Electrical Engineering: Necessity to Add Undergraduate Education of MEEM in China	589
<i>Yan Bingbing, Wei Tianlu, Chen Guangjun</i>	
Research on Construction of College Student's Entrepreneurship Education System	593
<i>Dayong Xu</i>	
Research and Practice of the Practical Ability Training at Independent Colleges for Applied Talents	603
<i>Qinxian Liu, Wei Lv</i>	

Chinese and Western Cultural Conflicts under Sino-foreign Cooperative Education	609
<i>Lu Chanjiang, Feng Yan, Cheng Lanbo, Lv Weibin</i>	
Research and Reform of CDIO Engineering Education Mode	617
<i>Hanqi Yu, Niansheng Yin, Jingqiu Wu, Qiqing Xu, Xue Yang</i>	
Reform on Curriculum Project in Management Information System Based on Project Management Technology	621
<i>Xiaohong Deng, Xuemei Hu, Yanjun Liu</i>	
Lecture Notes in Electrical Engineering: Discussion about the Way of Training Mechanical Applied Type Undergraduate Talents	627
<i>Chen Guangjun, Yan Bingbing, Yu Yonghong, Liu Qisheng</i>	
Talk about Students' Ability Training in Teaching Practice Reform of Graduates from Engineering Course	631
<i>Liu Yuyan, Chen Lin</i>	
Relying on the Discipline Superiority, to Construct Material Molding and Control Engineering	637
<i>Chen Lin, Liu Yuyan, Yang Jichun</i>	
Features, Training and Participation of National Computer Simulation Grand Prize	645
<i>Li Cong-ying, Han Lei, Lu Jian-hua, Yu Jin-yong</i>	
How to Improve the Teaching Effect of Material Mechanics	653
<i>Mei Yang, Xingguo Wang, Lihui Ma</i>	
The Research of ERP Courses Teaching in Third-Batch Colleges	657
<i>Liu Jinan</i>	
Analysis on Factors of Regional Logistics of China – ASEAN: BASED on the Angle of the Gravity Model	663
<i>Zijuan Gong, Lin Gui</i>	
Construction of Comprehensive Experiment Platform of Mechanical Major	671
<i>Hongliang Guo, Dongjie Zhao, Ling Zhao, Yanxia Wei, Yan Zhu</i>	
Comparison and Analysis on Education System of Practical Talents of China and Germany	677
<i>Zhu Fanglai, Zhang Qiang, Sun Xiaoli, Li Zhengguo</i>	
Research on the Construction of Specialized Teaching Team in Independent College Based on Symbiosis Theory	685
<i>Yongfeng Cao</i>	

Optimal R&D Subsidies under Technology Licensing	691
<i>Lili Zhu, Qingyou Yan</i>	
Employment Service and Instruction for the Disadvantaged Group of University Graduates in the New Period Guided by “Three Hopes”	697
<i>Yan Gu, Dongjie Zhang, Jing Zhang</i>	
A Research on CDIO Engineering Training Innovative Practice Teaching Program in Ethnic Areas	703
<i>Jiansheng Peng</i>	
The Electronics Experiment Teaching Reform Base on the CDIO	709
<i>Qingjin Wei, Jiansheng Peng</i>	
The Employment Services and Guidance of the Disadvantaged Groups of Electronics Professional College Graduates	715
<i>Yong Qin, Jiansheng Peng</i>	
Research and Practice of the Teaching Reform for Professional Course	721
<i>Xining Li</i>	
Practice Teaching of Disaster Prevention and Reduction for Engineering Major from 3·11 Earthquake	727
<i>Xin Xi, Shu Ying Qu, Shan Shan Hao, Li Xiang Wu</i>	
Experiment on Students’ Expression Ability Affected by Language Meme Training in English Classroom	733
<i>Ningman Xia</i>	
The Main Problems of Learning Style Construction in Institution of Higher Education	741
<i>Hua Sun, Yanjun Zhao</i>	
Exploration of Engineering Education Reform in New Application Oriented Institutions	747
<i>Wei Zu, Xingyong Xie, Fuchun Fan, Jinquan Wang</i>	
Research on the Education of Application Type Undergraduates Majored in Engineering	753
<i>Chao Zhen Yang, Wei Min Zhao, Shi Quan Zhang</i>	
Research and Practice to Improve the Design Capacity for Application Engineer in Mechanical Professional	761
<i>Chao Zhen Yang, Xu Xia Zhu, Wei Min Zhao</i>	
Author Index	767

Dimensions of Perceived Risk and Their Influence on Consumers' Purchasing Behavior in the Overall Process of B2C

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Abstract. The influence of perceived risk on customers' purchasing behavior still plays an important role in the overall process of business to customer(B2C) E-commerce, though the extent to which it does so varies according to the characteristics of consumers. In this study, perceived risk dimensions affecting customers' purchasing behavior and their structural relationships were investigated through a customer survey and statistical analysis using the methods of confirmatory factor analysis and structural equation model. The result shows that the five independent dimensions, perceived health risk, perceived quality risk, perceived time risk, perceived delivery risk and perceived after-sale risk affect significantly customers' purchasing behavior, while perceived privacy risk, perceived social risk and perceived economic risk are the less relevant factors.

Keywords: risk dimensions, perceived risk, consumers' purchasing behavior, overall process of B2C.

1 Introduction

Consumers' perceived risk is considered to be one of the important factors that impact on consumers' purchasing behavior in their decision-making, and it is also one of the important research themes for consumer purchasing behavior analysis of shopping online in E-commerce [1, 2]. Many prior researches focused on the risks in the phase of online transactions, put forward the structure of risk dimensions in different perspectives such as the lack of security, privacy risk, the credibility of online retailers or reliability risk[3, 4], functional risk, shopping risk, time risk, social risk, psychological risk and so on[5, 6]. Among them, there were little studies about the structure of risk dimensions and their influence on consumer purchasing behavior for the overall process of B2C, especially based on empirical research.

The overall process of B2C includes information searching before buying, the choosing of products and the service after purchasing. Therefore, the consumer's perception of risk should not only in the phase of online transactions but also in every phases of the overall process, and so does the influence.

Although different researchers have proposed different dimensions of perceived risk, there is a gap about the dimensions of perceived risk in the overall process of B2C and further what dimensions have significant influence on consumers' purchasing behavior. We addressed this gap in the literature by attempting to provide an empirical exploration of the dimensions of perceived risk, their impact on consumers' purchasing behavior, and the relationships between constructs in the overall process of B2C.

In this paper, based on risk perception theory [7, 8], we empirically tested what risk factors from the overall process of B2C may really cause consumers' perceived risks and examined what dimensions of perceived risks significantly influenced consumers' purchasing behavior in the overall process of B2C.

2 Literature Review and Research Hypotheses

The original concept of perceived risk is proposed by R. A. Bauer [7]. Cox [8] gave the specific explanation of perceived risk. The dimensions of perceived risk are the specific contents or types of perceived risk. According to the theory of consumers' perceived risk, when consumers face uncertainty and potentially undesirable consequences as a result of purchase, they will perceive risk [9, 10]. The more risk consumers perceive, the less likely it is that they will make a purchase. Therefore, Perceived risk is powerful at explaining consumers' behavior because "consumers are more often motivated to avoid mistakes than to maximize utility in purchasing" Mitchell [11].

Many previous researches have studied perceived risk dimensions from different perspectives. Mitchell [12] showed that consumer perceived different levels of risk at every stage in the purchasing process. Dahai Dong et al. [13] analyzed four dimensions of perceived risk through qualitative exploration. Xiang Sun et al. [14] verified the perceived risk with seven dimensions, and proposed the sources of risk which had larger impact on consumer perceived risk. Anne-Sophie Cases [15] studied the four sources, and his empirical results showed that secure payment, money-back guarantee and product replacement are the top three risks which will affect the consumer decision-making.

In E-commerce, perceived risk is often a perception held as a natural characteristic by many customers [16, 17]. Greater perception of risk on the part of consumers acts as a deterrent to customer purchase intentions. Several authors have observed that the perceived risk in e-commerce has a negative effect on shopping behavior on the Internet [18], attitude toward usage behavior [19, 20, 21] and intention to adopt E-commerce [22].

Diverse studies have also obtained empirical evidence that supports the effect of perceived risk on consumer purchasing behavior. Cunningham et al. [23] proposed that private risk, product risk and the risk of unknown origin would impact on the online shopping. Based on the investigation for perceived risk and online purchasing behavior, Forsythe and Shi [24] found that perceived risk significantly related to online purchasing behavior, which could explain the barriers of online shopping. Shouming Chen and Jie Li [25] built four structural equation models to measure six dimensions of perceived risk and their influences on consumer

purchase intention. A. Herrero Crespo et al. [5] studied the perceived risk that would influence consumer's attitudes and willingness for online purchasing.

According to traditional literature on perceived risk dimensions and with the empirical evidence obtained from E-commerce context, considering the risk source from the overall process of B2C and our current cases studied, the definition of the variables used in this study are shown in table 1.

Table 1. Definition of variables in literature and proposed in this study.

Variables	Definition	Related Literature and Our Research
Social risk	Potential loss of status in one's social group as a result of adopting a product or service, looking foolish or unpopular.	Cunningham (1967), Stone and Gronhaug (1993)
Economic risk	The potential monetary outlay associated with the initial purchase price as well as the subsequent maintenance cost of the product, and the potential financial loss due to fraud	Cunningham (1967), Stone and Gronhaug (1993)
Privacy risk	Potential loss of control over personal information, when the information is used without permission.	Jarvenpaa and Todd (1997), Featherman and Pavlou (2003)
Time risk	Potential loss of time associated with making a bad purchasing decision by wasting time researching, shopping, or have to replace the unexpected goods.	Cunningham (1967), Stone and Gronhaug (1993)
Quality risk	The possibility of the product malfunctioning and not performing as it was designed and advertised and therefore failing to deliver the desired benefits	Cunningham (1967), Stone and Gronhaug (1993)
Health risk	Potential loss of health because of prolonged use of computer will cause fatigue or visually impaired, pressure on one's heart, or buying counterfeit products which is harmful to one's health.	Featherman and Pavlou (2003) This study
Delivery risk	Potential loss of delivery associated with goods lost, goods damaged and sent to the wrong place after shopping.	Dan Yu et al.(2009) This study
After-sale risk	Potential loss of after-sales associated with products problems, commercial disputes, and service guarantee.	Dan Yu et al.(2009) This study
Purchasing Behavior	The possibility of consumer behavior to doubt, give up, cut down spending, cut down frequency, and to put off one's purchasing because of perceived risks.	This study

From above discussion, the following research hypotheses are proposed:

- H1: The perceived risk in the overall process of B2C E-commerce is constructed by eight dimensions.
- H2: Social risk has a negative influence on consumers' purchasing behavior.
- H3: Economic risk has a negative influence on consumers' purchasing behavior.
- H4: Privacy risk has a negative influence on consumers' purchasing behavior.
- H5: Time risk has a negative influence on consumers' purchasing behavior.
- H6: Quality risk has a negative influence on consumers' purchasing behavior.
- H7: Health risk has a negative influence on consumers' purchasing behavior.
- H8: Delivery risk has a negative influence on consumers' purchasing behavior.
- H9: After-sale risk has a negative influence on consumers' purchasing behavior.

3 Formation of Questionnaire and Data Collection

3.1 Formation of Questionnaire

Based on the related literatures and our previous studies, we designed a questionnaire. Firstly, we summarized all the items about perceived risks and consumer purchasing behavior in the previous studies. Then, after pre-investigating to our colleagues and college students, some items were adjusted. At last, we got our final questionnaire, which included two parts, in part1 there are 32 measurement items, which were used to measure the risk dimensions in the overall process of B2C; in part2 there are 5 items, which were used to measure the consumers' purchasing behavior. We used Likert scale of 1-5 with end points of "strongly disagree" and "strongly agree" to measure these items.

3.2 Data Collection

The data that we employed for this research were collected using interview, investigating online and in business streets from October, 2010 to January, 2011. Just those customers who had shopped on B2C websites before were randomly selected as our respondents. For this research the three main sampling frame people were white-collar from company, blue-workers from factory, and college students from university, more than half of them came from Shenzhen, China. Information was missing on key variables for some of the respondents were deleted. Therefore, we were only able to use information on 388 cases. This number is more than ten times of 37 items, so we can use them for the further analysis. In table2, we provided a description of the respondents that were used in the empirical analysis.

Table 2. Descriptive statistics of respondents' characteristics

Demographic variables	Percentage number of respondents	Demographic variables	Percentage number of respondents
Age: Age of the respondent		Experience of online purchasing	
18~24	67.5	≤3	32.5
25~30	19.3	4~8	28.6
31~34	8.0	9~15	21.9
≥35	5.2	≥16	17
Gender of the respondent			
Male	54.1		

4 Data Analysis and Results

4.1 Measurement Model Analysis

Exploratory factor analysis is used to extract a number of common factors. Firstly, SPSS17 was used to test the KMO and Bartlett's test of sphericity. The KMO of part1 is 0.836, Bartlett's test the p value is 0.000. The KMO of part2 is 0.882, Bartlett's test the p value is 0.000. These values indicate that the data from our questionnaire are acceptable to perform further factor analysis.

Then, for part1, we got 30 items kept in, by using principal component analysis method and variance maximization rotation, two items T31 and T32 are deleted because their rotated factor loadings are less than 0.4. Their factor loadings are shown in Fig.1 and variance contribution rates are shown in Table3. Finally, eight common factors are extracted from the remaining 30 items. The cumulative variance contribution rate is 88.627%, which could be used to analyze the contents and types of perceived risk for the overall process of B2C. We also got one common factor from part2. They are shown in Table3.

According to the integrated meaning of the common factors, we named the eight common factors as follows: perceived health risk(PHR), perceived quality risk(PQR), perceived privacy risk(PPR), perceived economic risk(PER), perceived time risk(PTR), perceived social risk(PSR), perceived delivery risk(PDR) and perceived after-sale risk(PAR). For the one common factor from part2, we named it as perceived purchasing behavior (PPB).

We use Cronbach's α coefficient to conduct reliability analysis. Table3 shows that α value of each dimension is greater than 0.8. The result indicates that the survey data in our research are true and reliable. In addition, the composite reliability value CR of each dimension is greater than 0.9, which indicates that our survey data have a high reliability.

In this paper, we used average variance extracted (AVE) values to test the convergent validity and confirmatory factor analysis for testing discriminate validity. Table3 shows that the AVE of each dimension is greater than 0.7, therefore, the survey data in our research have a good convergent validity.

Table 3. Risk dimensions and purchasing behavior α , CR and AVE value

Dimension	Item	Variance Contribution	α	CR	AVE
Perceived Health Risk(PHR)	T2,T1,T4,T3,T11	17.245%	0.923	0.944	0.772
Perceived Quality Risk(PQR)	T25,T24,T26,T23,T27	27.059%	0.914	0.940	0.768
Perceived Privacy risk(PPR)	T15,T17,T16,T22	8.129%	0.875	0.954	0.841
Perceived Economic risk(PER)	T13,T14,T12	7.896%	0.886	0.930	0.819
Perceived Time risk(PTR)	T30,T28,T21,T29	13.079%	0.905	0.934	0.780
Perceived Social risk(PSR)	T6,T7,T5	7.116%	0.843	0.954	0.872
Perceived Delivery risk(PDR)	T18,T20,T19	4.554%	0.907	0.922	0.798
Perceived After-sale risk(PAR)	T10,T8,T9	3.509%	0.858	0.921	0.797
cumulative variance		88.627%			
Perceived Purchasing Behavior (PPB)	J1,J2,J3,J4,J5	90.380%	0.873	0.913	0.9035

4.2 Structural Model Analysis

We conducted confirmatory factor analysis (the risk dimensions model) for the survey data with AMOS 17. The fit indexes of the hypothesis H1 are shown in Table4. These indexes are above the recommended levels. The indexes in Table4 show that there is a good goodness-of-fit between the dimension model and the survey data. H1, which assumes that there are eight dimensions of perceived risk in the overall process of B2C, is supported.

The results confirmed the existence of eight dimensions. These dimensions showed no-cross construct loadings above 0.5, indicating good discriminate validity. The hypothesis H1 is verified.

Table 4. Goodness-of-fit indexes of the dimensions model

Indexes	χ^2	df	χ^2/df	NFI	IFI	CFI	GFI	AGFI	RMSEA
recommended levels	-	-	<3	>0.9	>0.9	>0.9	>0.9	>0.8	<0.08
the risk dimensions model	658.43	372	1.77	0.951	0.981	0.981	0.923	0.916	0.046
the purchasing behavior model	941.257	519	1.81	0.947	0.971	0.971	0.913	0.906	0.055

We also built the purchasing model, which is used to verify the hypothesis H2-9. The indexes in Table4 show that there is a good goodness-of-fit between the purchasing behavior model and the survey data. The path coefficients and significant levels of the study model are given in Fig.1.The results show that hypotheses H5-9are supported.

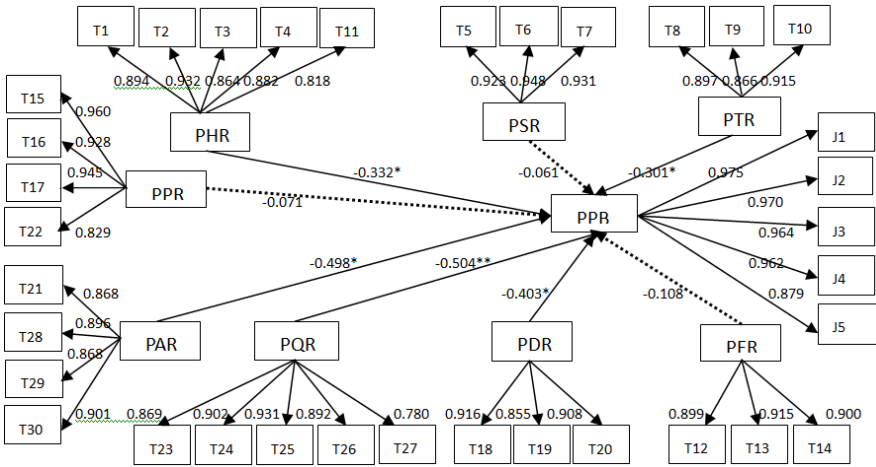


Fig. 1. Study model with path coefficient

5 Discussions

The results show that H5-9 are supported. H5, which assumes that time risk has a negative influence on consumers' purchasing behavior, is supported. Consumers are not patient to wait a long time because they usually take delight in seeking new thing, so a longer waiting time for delivery and service would make them lose their interested in and affect their online shopping willingness. For H6, the result shows that quality risk has a significant negative influence on consumers' purchasing behavior. Most consumers prefer products with low prices but first good quality is the principal criteria. H7, which assumes that health risk has a negative influence on consumers' purchasing behavior, is supported. Most consumers like to spend much time on Internet, especially the young people. But much adverse information, stay online too long or counterfeit goods bought from online shopping would affect their physical and mental health. For H8 and H9, the results show that delivery and after-sale service risks have significant negative influences on consumers' purchasing behavior, especially in B2C E-commerce. When consumers perceived the potential problems in delivery such as goods lost, damaged, or delivered to a wrong place, they would put off the purchasing online. Sometimes once they think it's difficult to solve commercial disputes and haven't after-sales service guarantee, they would give up their purchasing online.

A major finding of this study is the non-significant of economic risk on consumer purchasing behavior, likewise social risk and privacy risk. In this study, we concern whether the additional fees caused by the difference between online shopping and offline shopping may impact consumers' purchasing behavior. The result shows it is not significant. We believe that even the counterfeit goods may cause economic losses, but for most vendors who have "seven days unconditional return" can reduce the economic loss. Besides, guaranteed by Alipay in China,

banks, credit cards companies as intermediaries. These intermediaries usually guarantee a refund or other improprieties result in economic loss. As Internet usage has come of age such that the online customers now view security and privacy as a basic requirement, it may help us explain why perceived privacy risk is not significant impact on online consumer.

6 Conclusions

There are abundant research on the effect of perceived risk toward the purchase decision and the determinants of buying intention in online context. To date, attempts to study both risk dimensions and consumers' purchasing behavior jointly have, however, proved insufficient and have lacked depth. Thus, we have examined such important variables as perceived risk dimensions in the overall process of B2C, and the impacts for each of them on consumers' purchasing behavior. At the same time, an additional contribution of our study lies in the consideration of consumers' purchasing behavior and perceived risk as multidimensional concepts.

This research provides a new perspective to study the construction of perceived risk dimensions, which lay the foundation for further research on B2C shopping online decision-making.

Implications of both a theoretical and practical nature also emerge from our study. The former, concerning the consideration of perceived risk toward consumers' purchasing behavior in the overall process of B2C as a eight-dimensional construct—quality risk, health risk, delivery risk, after-sale risk—opens up new avenues of research. Not only are individuals involved in B2C online transactions, but are also involved with the process before buying and after purchasing online. Our research is also empirically innovative, as it has examined different dimensions of risk and performed a separate analysis of the effects of each dimension on consumers' purchasing behavior. Furthermore, we had considered the role played by quality risk, health risk, time risk, delivery risk, and after-sale risk, in consumers' purchasing behavior, which are more relevant in the online behavior of individuals than social risk, privacy risk, and economic risk.

There are some limitations in this paper. As the group's resources and energy are limited, the main source of this survey data are from Shenzhen, this may affect the respondents broadly representative. In future studies, we should consider the influences of individual characteristics of the respondents such as gender and experience on the composition of perceived risk dimensions and analyze their different influences on consumers' purchasing decision-makings.

References

- [1] Sandra, M.F., Shi, B.: Consumer patronage and perceptions in Internet shopping. *Journal of Business Research* 56(11), 867–875 (2003)
- [2] Luo, X., Li, H., Zhang, J., Shim, J.P.: Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: An empirical study of mobile banking services. *Decision Support Systems* 49(2), 222–234 (2010)

- [3] Vijayasarathy, L.R.: Predicting Consumer Intentions to Use on-line Shopping: The Case for an Augmented Technology Acceptance Model. *Information & Management* 41(6), 747–762 (2004)
- [4] Vellido, A., Lisboa, P.J.G., Meehan, K.: Segmentation of the on-line shopping market using neural networks. *Expert Systems with Applications* 17(4), 303–314 (1999)
- [5] Herrero Crespo, Á., Rodríguez del Bosque, I., García de los Salmones Sánchez, M.M.: The influence of perceived risk on Internet shopping behavior: a multidimensional perspective. *Journal of Risk Research* 12(2), 259–277 (2009)
- [6] Cunningham, L.F., Gerlach, J.H., Harper, M.D., Young, C.E.: Perceived risk and the consumer buying process, Internet airline reservations. *International Journal of Service and Market* 16(4), 357–372 (2005)
- [7] Bauer, R.A.: Consumer behavior and risk taking, in *Dynamic Marketing for a Changing World*. American Marketing Association, Chicago, 389, 39 (1960)
- [8] Cox, D.F., Rich, S.U.: Perceived risk and consumer decision making—the case of telephone shopping. *J. Market Res.* 1(4), 32–39 (1964)
- [9] Dowling, G.R., Staelin, R.A.: Model of perceived risk and intended riskhandling activity. *Journal of Consumer Research* 21(1), 119–134 (1994)
- [10] Taylor, J.W.: The role of risk in consumer behavior. *Journal of Marketing* 38(2), 53–60 (1974)
- [11] Mitchell, V.W.: Consumer perceived risk: Conceptualizations and models. *European Journal of Marketing* 33(1/2), 163–195 (1999)
- [12] Mitchell, V.F.: Understanding Consumers' Behavior: Can Perceived Risk Theory Help. *Management Decision* 30(3), 26–31 (1992)
- [13] Dong, D., Li, G., Yang, Y.: Research of the Perceived Risk Factors by Consumers in Internet Shopping. *Chinese Journal of Management* (01), 55–60 (2005) (in Chinese)
- [14] Sun, X., Shuoyang, Z., Danrong, Y.: The Source of consumers Risk and Their Perception in B2C E-commerce. *Chinses Journal of Management* (1), 45–48 (2005) (in Chinese)
- [15] Anne-Sophie, C.: Perceived risk and risk reduction strategies in internet shopping. *The International Review of Retail, Distribution and Consumer Research* 12(4), 375–394 (2002)
- [16] Kim, D.J., Steinfield, C., Lai, Y.-J.: Re-visiting the role of web assurance seals in business-to-consumer electronic commerce. *Decision Support System* 44(4), 1000–1015 (2008)
- [17] Skek, S.P.W., Sia, C.-L., Lim, K.H.: A preliminary assessment of different trust formation models: the effect of third party endorsements on online shopping. In: *The 36th Annual Hawaii International Conference*, pp. 1–10 (2003)
- [18] Park, J., Lee, D., Ahn, J.: Risk-focused e-commerce adoption model: A cross-country study. *Journal of Global Information Technology Management* 7(2), 6–30 (2004)
- [19] O'Cass, A., Fenech, T.: Web retailing adoption: Exploring the nature of internet users web retailing behaviour. *Journal of Retailing and Consumer Services* 10, 81–94 (2003)
- [20] van der Heijden, H.T., Verhagen, M.C.: Understanding online purchase intentions: Contributions from technology and trust perspectives. *European Journal of Information Systems* 12(1), 41–48 (2003)
- [21] Shih, H.P.: An empirical study on predicting user acceptance of e-shopping on the Web. *Information and Management* 41, 351–368 (2004)

- [22] Pavlou, P.A., Featherman, M.S.: Predicting E-services adoption: A perceived risk facets perspective. *International Journal of Human-Computer Studies* 59, 451–474 (2003)
- [23] Cunningham, S.M.: The major dimensions of perceived risk. In: Cox, D.F. (ed.) *Risk Taking and Information Handling in Consumer Behavior*, pp. 82–108. Harvard University Press, MA (1967)
- [24] Forsythe, S.M., Shi, B.: Consumer patronage and risk perceptions in internet shopping. *Journal of Business Research* 56(11), 867–875 (2003)
- [25] Chen, S., Li, J.: Factors Influencing the Consumers' Willingness to Buy in E-commerce. In: *International Conference on E-Business and Information System Security*, pp. 1–8 (2009)
- [26] Yu, D., Dong, T., Liu, R.: Study of Types, Resources and Their Influential Factors of Perceived Risks in Purchase Online. *Journal of Dalian University of Technology* 28(2), 13–19 (2007) (in Chinese)

Research on the Mode Selection of Technology Transfer and Innovative Process

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Abstract. The formation process of technology transfer pattern is closely related to the general, mature and application of technology. Technology transfer is a main factor making technology turned into productivity successfully. Both providers and receivers of technology transfer should choose technology transfer modes that meet their own conditions, including basic conditions and technical conditions. For enterprises and institutions of universities, technology transfer process is in fact the selection process of technology transfer mode, which often determines the application effect of technology and economic benefits. This paper analyzed domestic and international technology transfer process and practice between university and enterprise firstly, and then researched cooperation ways, systems, conditions, contracts for constrains and distributions of interests. Analyzing cooperation rules and systems of technology transfer, it is considered that mode selection and process are the key factors to influence effects of technology transfer.

Keywords: technology transfer, mode, conditions, research.

1 Introduction

In recent years, science and technology effectively promote the development of productive forces, which gradually becomes a key productivity element to economic development together with traditional material elements. But it needs a complicated process to turn elements into productivity. Technology transfer is crucial for science and technology to upgrade productivity level [1].

Researches in university should focus on domestic and international science and technology development frontier. Research projects potential to be industrialized take improving productivity as the target. Once basic engineering technology theoretical achievements that have the application prospect in the market were tested and verified by theory, the next step should be application research and development. Enterprise is sensitive to market and driven by potential benefits, which is the cooperation foundation between enterprise and university on technology transfer. From this basic point, the effective technology transfer from universities to enterprises can realize targets and interests of both sides.

2 The Comparison and Selection of Technology Transfer Modes

2.1 Technology Transfer Modes

(1) Technology transfer mode. University as technology owner provides technical achievements to enterprise, and the technology receiver pay certain amount of remuneration to the technology provider. University provides technology and achievements possessing potential commercial value for enterprise to purchase and use in the forms of the technology authorization, technology license, technology consultation and technology service. It's the duty of university as a technology transfer "source" [2].

(2) Participation through cooperation mode. On the basis of resource integration, the enterprise takes participation in the technology transfer together with university by contracts. This promotes the transformation from technology to realistic productive forces and improves enterprise's technology innovation ability. Generally, enterprise advances into technology research and development when university has no technical achievements but only certain technology or technical ability. Meanwhile, university also often involves in follow-up parts of the technology transfer, providing the necessary technical supports and services.

(3) Establishing enterprise mode. Research agency in university taking his talents and technology as the foundation sets up an enterprise aimed at product manufacturing and service using the technical achievements in university with investment of others. In general, this mode has two necessary conditions: first, the member cooperating with university in technical development is one of enterprise founders; second, the enterprise's core technology is transferred from university.

So high technology transfer needs more close cooperation between university and enterprise [3].

2.2 The Main Process in Technology Generation and Transfer

To realize the technology transfer, there are three necessary stages- laboratory, engineering and industrialization. The degree university and enterprise participate in these stages decides technology transfer mode. In the technology transfer mode, laboratory stage accomplished by university independently, while the stages of production, commercialization and industrialization are realized by the enterprise. University transfers its own R&D achievements to enterprise directly through technology market.

In the participation through cooperation mode, the first two stages of technology transfer are completed by jointly, and the final commercialization and industrialization stage are completed only by the enterprise. In the establishing enterprise mode, university involves in all three stages of technology transfer. University sets up an enterprise itself or invests in the enterprise with its technical achievements or proprietary technology license and holds larger percentage shares in these enterprises.

3 The Guarantee Factors of Technology Transfer

3.1 Basic Conditions

(1) The preparation of technical basis. Rely on technology innovation platform with optimized resource configuration, the university's research centers, key laboratories, science and technology innovation platforms mainly focus on basic research as well as application technology. Taking the advantages of talents, knowledge, technology and information, the university tacks scientific research subjects which are original and frontier, or related to national security and economic development, and creates technological achievements in basic application constantly. This not only trains technology innovation talents and strengthens innovation ability, but also gradually lays the foundation to improve productivity level.

(2) Preparation of technical achievements. Technological research centers, engineering research centers and university's science and technology zones formed by interdisciplinary and border-crossing develop high-tech integrated achievements owning competitive advantages in the market in special. These agencies seek production-teaching-research combination partners of intensive technology and talent to develop technological achievements possessing self intellectual property rights and certain application prospect and valued by enterprise.

3.2 Technology Conditions

(1) Advanced technology achievements are the guarantee of technology transfer. Engineering-oriented basic theoretical research achievements must be advanced, and recognized by industry and market economic forecasts. Also they possess the practice of engineer application and the basic conditions of technology transfer.

(2) The participation of technical personals is the guarantee of technology transfer. During the process of technology transfer, there are still some problems even if the technology can be developed in the actual application. In reality, the both sides of co-operation tend to have different understanding on technology transfer. It takes a period of time to reach an agreement and create the software and hardware conditions for technology transfer. In addition, there is another problem that the implementation personnel are inseparable from technology in the process of technology transfer. To sign the technical service contract with technology personnel as constraints of technology transfer, can make sure that technical personnel work wholeheartedly until technology transfer completed. According to commercialized requirements, technology receiver cooperates with technical personnel closely and develops product production technology after receiving technical achievements [4].

(3) The sustainability of technology research. Technology provider needs the stamina in technology research and development. When it cooperates with technology receiver, engineering research on next product has already been conducted. This way can achieve technical reserves to renew products, guarantee the sustainability of technology transfer process and meet product market demand.

4 Exploration for Innovation Mechanism of Technology Transfer

There are two inner connection lines when university transfers technology to enterprise. The university provides innovative technology achievements to the enterprise, and then converted into products manufacturing technology and products by enterprise. Products are transformed into commodity by industrialization after gaining market acceptance. This is called technology chain. On the other hand, enterprise use capital to purchase products technology from university and the capital is invested to innovate knowledge and technology results continuously, which is called capital chain. Thus the cycle is formed between technology chain and capital chain. University mainly researches engineering while enterprise mainly realizes industrialization. Enterprise's timely intervention realizes the seamless link in the technology transfer process.

It is critical that technology transfer is operated within the standard system. Both technology provider and receiver have been familiar with their respective operation and rules before the operation mode and rules, and can complete whether application research or production independently. But in the framework of enterprise, technology transfer must suffer a series of constraints such as cooperation agreement, proprietary technology license, terms of technical services. Enterprise's management, human, distribution, incentives and rewards and punishment system related to technology transfer, regulate the personal responsibilities and interests for both sides. Mobilizing personnel's subjective initiative fully, coordinating the problems and seeking the best way to solve the problem are the fundamental expression of good operation mechanism.

References

1. He, J., Hao, M., Li, Z., et al.: Technology Transfer of Research-oriented University and Its Countermeasure. *Education Research* 8, 26–28 (2007)
2. Xu, L.: *The Domestic and International Technology Innovation Service Systems*, p. 22. Xinhua press, Beijing (2002)
3. Yi, G.: The Successful Experience of Technology Transfer in American Institutions and Universities. *Comparative Education Research*, 37–38 (2002)
4. Fan, X., Chen G., Yang, S.: Technology Transfer and the Analysis of Its Relevant Concepts Meanings. *Science and Technology Management Research* 6, 44–45 (2000)

ARCH Model Approach to Measuring Function of Government in the Science & Technology Auto-organization System

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Abstract. To assure stable transformation of science & technology reform in China, function of government should be relocated in the science & technology system. ARCH model is adopted to make an empirical analysis to study the function of government in the science & technology system. The results indicate that there is obvious difference in science & technology mechanism between western market economy and ours. In China, science & technology can not reach stable state by its own force, except for exterior force. Under the condition of incapability of science & technology system to stabilize itself, exterior intervention of government on science & technology system is the premise for stabilization, otherwise, it will plunge into fluctuation.

Keywords: ARCH, Exterior Intervention, Failure of Market, Science & Technology System.

1 Introduction

As a subsystem of economy system, science & technology system has function of auto-stabilization and auto-organization. Auto-organization inducts the system to the greater negative entropy, results in the system being apart from equilibrium state, which causes system to fluctuate in great breadth. Auto-stabilization keeps the system under the foregoing organizing state, namely it has the function to eliminate fluctuation and return to equilibrium state. When systematically analyzing the fluctuating mechanism of Chinese science & technology system, we should distinguish the exogenous impact and endogenous conducting mechanism. Endogenous conducting mechanism is auto-regulation mechanism between variables in inner science & technology system and reaction to exogenous impact, represented as distributing lagging relation in Mathematics form, which reflects the endogenesis of science & technology activity. What is called the exogenous impact mechanism means science & technology activity caused by exterior impact through interior conduction. Exogenous impact mechanism roots in spontaneous change of exterior variables which leads to science & technology system stochastic or periodic change. Thereby, it comes to conclusion that exogenous impact is an

important cause of science & technology system fluctuation; endogenous conducting mechanism is auto-response and auto-adjustment in answer to impact in interior science & technology system. Under synthetical effect of the two functions, fluctuation can be revised and eliminated incessantly through auto-stabilization. In the paper, the author reviews and analyzes the dynamic character of science & technology system operation in China, so as to identify the auto-stabilization and auto-organization effect on science & technology system respectively. At the same time, we appraise the performance of science & technology system to bring forward an analysis framework for government decision-making in the reform of science & technology system.

The issue of the function of government in the science & technology system arouses widespread concerns [1,2,3]. But most of relative literatures usually adopt qualitative approach, whereas quantitative analysis is inadequate. So it is necessary to make more in-depth and comprehensive analysis for the sake of providing an empirical support for government's function in the science & technology system.

2 Data Selection and Statistic Analysis

Science & technology input and science & technology output are the main elements in science & technology system. Generally, science & technology input is denoted by science & technology expenditure, science & technology output is denoted by the number of patent application and acceptance or the number of dissertation. In the paper, we decide to use science & technology expenditure as science & technology activity, Sample data involve 1953-2008. The reason lies in the following two points, above all, the problem of obtaining science & technology output data. At first, we consider to review the fluctuation character of science & technology system from the input and output respectively. But after checking relative data, we find that there is lack of data of patent application and acceptance before reform in china. Generally, more than 50 sample data are needed when using ARCH model. If selecting merely approximately 20 years patent data, it can not reflect completely the fluctuating character of science & technology output in China because of lack of time series; in addition, there is strong relationship of fluctuation between science & technology input and output, we calculate the pill correlation coefficient of expenditure and patent application with data since 1985. The result indicates that there is prominent relationship between the two variables. $r=0.9210(p=0.0025)$. Based on the above analysis, we believe that the variable of science & technology expenditure can better reflect the character of science & technology system.

We select 1953-2008 year data as samples, data come from «China Stat Annals» and «China Scientific Stat Annals». Since 1953, Chinese science & technology expenditure is ascending gradually. For the sake of eliminating shrewd fluctuation of variables, we switch the science & technology expenditure by logarithm, namely $\ln E$. To obtain the fluctuation rate, we switch the data to yearly fluctuation R_t with first difference. Namely $R_t = \ln E_t - \ln E_{t-1}$. Figure 1 is the yearly fluctuation rate series of science & technology expenditure.