

# Profit distribution and managers' behavior in vertical integrated medical delivery systems - An experimental economics study

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## Research article

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## Abstract

**Background** Fragmentation of medical care has become one of the main reasons for the inefficiency of medical delivery systems. Vertical integration of medical delivery systems (VIMDS) is a reform direction in the world. Managers' behavior toward profit distribution is an important factor that influences them to pursue the goal of VIMDS. We conducted a controlled economics experiment to explore decision-making by managers of medical institutions in respect of profits and what influences the distribution mechanism in VIMDS.

**Methods** Undergraduate and postgraduate Students majoring in health management, and administrative staffs from hospitals were recruited to make choices in the role of directors of institutions. Z-Tree software was used to design the experimental program. 96 subjects participated in the experiment. We gathered 479 valid contracts.

**Results:** 66.39% of the subjects choose flexible contracts. The median of the bidding distribution rate to community health service centers of all auctions was 18.50%. The final distribution rate is about 3 percentage points higher than the bidding distribution rate. The median of the effort level was 9.00. There was a significant correlation between the improvement rate and the choice of effort level ( $p < 0.05$ ) in flexible contracts.

**Conclusions:** The hospital managers have a preference for flexible contracts because of uncertainty in the medical system. Community health service center director may be perfunctory as shading in the integration. Flexible contract and sharing rate beyond participants' expectation motivate managers to make more cooperative behaviors.

## Introduction

Fragmentation of medical care has become one of the main reasons for the inefficiency of medical delivery systems in many countries (WHO 2009) which may subsequently raise health care expenditure and the expanding scale of hospitals. To solve these problems, many countries have begun exploring integration of health care systems<sup>[1-3]</sup>. Vertical integration of medical delivery systems (VIMDS), which involves integrating hospitals and community health service centers within a district to deliver continuous medical care, is one of the directions of healthcare reform in China<sup>[4]</sup>. This reform means an adjustment of managers' decision right and residual claimant right. Managers of medical institution attach importance to the implementation and efficiency of vertically integrated institutions. Related studies<sup>[5-6]</sup> show that profit distribution through integration among different institutions is a core problem. Managers' understanding of and attitude toward profit distribution is an important factor that influences them to pursue the goal of integration of medical delivery systems. Therefore, it is necessary to ascertain the relationship between profit distribution and managers' behavior in VIMDS.

The integration of medical delivery institutions is a contractual relationship between hospitals and community health centers. Because of the uncertainty of future states, these contracts are often incomplete. As time passes and the uncertainty is resolved, the contract can be completed. Grossman & Hart (1986)<sup>[7]</sup>, Hart & Moore (1990)<sup>[8]</sup>, and Hart (1995)<sup>[9]</sup> developed the incomplete contract theory of vertical integration. That provided a framework to analyze the cost and profits of ownership. On the basis, the incomplete contract theory explores the effects to vertical integration. Hart and Moore<sup>[10]</sup> introduced behavioral assumption to test the incomplete contract theory. They proposed that a contract provided a reference point for managers' feeling of entitlement and defined a concept, "nature state", which represented the uncertainties of the future political, economic, and other conditions. In their model, the trading partners meet in a competitive market before they enter a bilateral relationship. They sign an incomplete contract, and, if the parties fail to obtain the rights stipulated in the contract, the trading parties can always contribute a perfunctory performance instead of a consummate performance (they are reluctant to exert maximum effort in cooperating)<sup>[11]</sup>. Hart and Moore considered "perfunctory performance" as "shading". They assumed that contracts provide reference points for entitlements, which implies an interesting trade-off between contractual rigidity and flexibility<sup>[12]</sup>. A flexible contract allows the trading parties to adjust the terms of the contract according to nature states, but a rigid contract does not. However, the multiplicity of outcomes in flexible contracts makes it possible that parties may engage in shading. Fehr, Hart, and Zehnder<sup>[13-14]</sup> introduced an experimental method to validate reference point theory. Experimental economics is a method of studying decision-making behavior, through simulating realistic environments to examine the choices of decision-makers. Economic experiments have been used successfully in exploring the effects of vertical integration and decision-making behaviors in non-health fields<sup>[15-21]</sup>. The experiments were programmed and conducted using z-Tree<sup>[22]</sup>.

The prevalence of uncertainty in health care is a distinctive feature of health economics<sup>[23]</sup>. In VIMDS, the types of service, in addition to their content, their quality, and their cost, which should be provided among different medical institutions, are difficult to determine in advance, or the cost of determining them may be too great. To stipulate the contents that different medical institutions should provide and the specifications of referral through policy (like a complete contract) is difficult to achieve for the government. Therefore, the contract is incomplete.

According to the incomplete contract theory, and based specifically on its further development—the theory of Contracts as Reference Points—the managers of different medical institutions sign contracts for the method of distribution and the rate of future integrated profits. The contracts provide reference points. Then the community health service center managers choose the effort level they are willing to pay for integration. If they are satisfied with the distribution rate, "consummate performance" will be provided, instead of shading. Inspired by Fehr, Hart and Zehnder (2011)

[13], we conducted a controlled economic experiment to explore decision-making by managers of medical institutions in respect of profits and what influences the distribution mechanism in VIMDS.

The purpose of integrating hospitals and community health service centers is to change the phenomenon of disordered treatment. In an integrated system patients can visit to a community health service center firstly, then if need, refer to a hospital. However, hospitals may have fewer patients than before, so they have no incentive to integrate with the community health service center. And the community health service center cannot be competent to integrate because of capacity limitations. Therefore, the governmental agencies should motivate medical institutions to recommend the integration of medical delivery systems. So we assume that the social insurance department can package the medical insurance funds to the integration body in the form of a global budget. Medical insurance funds that are saved by integration are allocated in the integration body. The hospital managers and the community health service center directors need to determine the proportion of profits' distribution. Accordingly, we introduce a controlled economic experiment to analyze how medical institution managers make choice of profit distribution and the influence of their choices to VIMDS. Students and professionals were recruited to act as the managers of either hospitals or community health service centers in each experimental session.

## Experimental Method

### Details of the experiment and parameters

In the experiment, the hospital managers and community health service center directors are involved in the integration of medical delivery systems. The experimental materials include size, medical income, medical expenditures of the hospital and the community health service center, and interpretation of the experimental selection process.

In the experiment, subjects needed to represent hospital managers or community health service center directors to make decisions. There are 24 subjects in each experimental session; all participants are divided into 6 groups randomly by computer program. Each group has 2 hospital managers and 2 community health service center directors. In each period, managers of the two hospitals chose partners in turn. Community health service center directors have 2 chances to bid for the contract chosen by the hospital manager.

Firstly, hospital managers choose contract type (rigid contract or flexible contract). Secondly, the two contracts were chosen randomly in turn for community health service center directors to bid, and the directors auction bidding distribution rate ( $r_1$ ), which represents the percentage of integration profits allocated to community health service centers. The decision-making behaviors in two successive auctions have not interfered with each other. Community health service center directors have two chances to make bid for a contract. Each hospital can only work with one community, and each community health service center can have the opportunity to work with two hospitals. This design is due to the fact that there are more community health service centers than hospitals, so it is competitive for community health service centers to cooperate with hospitals. Each period signs 2 successful contracts at most. Then, according to different random nature states (good or bad), like the design of GHM, the nature state represents the uncertainty of the future. Hospital managers who chose flexible contracts need to decide the final distribution rate ( $r_2$ ). Finally, community health service center directors choose effort level. Effort level will ultimately affect the effectiveness of integration.

The design was inspired by Fehr, Hart and Zehnder (2011). In their design, the buyer determines a flexible or a rigid contract he wants to conclude. A competitive auction determines which seller gets the contract. Then the buyer provides the price and the seller chooses to provide the quality of the goods. In our experiment, the distribution rate represents "price", while effort level "quality". Decisions on the distribution rate and effort level are made independently at each auction.

In 2015, the China State Council issued guidance on the construction of the classification and treatment system and proposed that the residents in the county within the treatment rate increased to about 90.00%, and the proportion of total treatment that primary health care institutions accounted for was either greater than or equal to 65.00%. According to the survey data, the proportion of treatment in the primary medical institutions is 32.10%. To achieve the policy goal, the community health service centers need to make more effort. The basic assumption of the experiment is that medical insurance packages are paid to the integration body, and savings are used as compensation for hospitals and community health service centers. There is a lack of evidence about the amount of expense that can be saved by integration, so we give a virtual number in the experiment (as shown in Figure 1) and call it integration profit. We assume the different highest-profit  $Y^*$  in the two nature states, and the profit is  $Y^* \log(E)$ . Of course, it is related to the effort level. Figure 1 shows the relationship between effort level and integration profits in two nature states. Integration profits refer to the increased profit attained through integration; when there is no effort, the integration profit is zero. In the good state,  $Y^*$  is 1000.00, whereas it is 250.00 in the bad state.

#### *Experimental procedures*

*Step 1: The hospital managers choose contracts.*

One hospital manager can only choose one type of contract (either a rigid contract or a flexible contract). Two contracts will be generated within a group. The rigid contract means that the distribution rate cannot be adjusted. The final distribution rate of a flexible contract can be adjusted after the nature state is revealed.

*Step 2: The community health service center directors make bid for a contract.*

One random contract is auctioned off to the community health service center directors. The bidding distribution rate is the proportion of integration profits allocated to the community health service center. The bidding distribution rate is initially 10.00%, with an upper limit of 40.00% and it then increases by 0.50% every second, over a countdown period of 60 seconds. Each center director has a button to accept the contract before the end of the count down. The first center director who presses the button to accept the rate will get the contract. The bidding distribution rate is the final distribution rate in a rigid contract; however, in a flexible contract, it is the lower limit of the final distribution rate.

*Step 3: Determination of the nature state.*

A computerized random device determines the nature state for each contract independently. The highest profit is different in the two states. The probabilities of the two nature states are 0.80 and 0.20, respectively.

*Step 4: The hospital managers choose the final distribution rate.*

Once the nature state has been revealed, the hospital managers who chose flexible contracts determine the final distribution rate. The range of the final distribution rate is from the bidding distribution rate to 60.00%<sup>[24]</sup>. The hospital managers who choose rigid contracts have no choice to adjust.

*Step 5: The community health service center directors choose the effort level.*

Community health service center directors observe the states and the final distribution rate that hospital managers chose. Then, they determine their effort levels. Effort level 1 represents no effort, and effort level 10 represents the hardest effort.

*Step 6: Profit calculation.*

After the center directors' choices of effort levels have been made, the profits are calculated and displayed on subjects' screens. The profit (benefit) calculation formula is as follows:

community health service centers' benefit:  $B = r*Y*\log(E)$

hospitals' profits:  $P = (1-r)*Y*\log(E)$

*Step 7: New Round*

A new round begins. The participants are reassigned randomly to a new interaction group and go through these steps again. Each experiment has 10 rounds.

*Subjects and payments*

We organized 4 experiments which recruited 96 subjects. Three experiments were participated by undergraduate and postgraduates of Capital Medical University majoring in health management. They have the knowledge of hospital management and have good compliance with the experimental design. The remaining subjects are administrative staff from hospitals with 2–8 years work experience, which we called professionals. They have a better understanding of the actual management of the hospital, but they are "pure" compared with the real decision makers in hospitals. In each experiment, subjects were randomly subdivided into different groups before the start of each experiment. All interactions were anonymous, and the subjects did not know the personal identities of their partners.

To make sure that subjects fully understood the procedures and the payoff consequences of the available actions, each subject was given a detailed set of materials before the experiment started. We provided a payoff according to the choice of subjects, with the purpose of motivating the subjects and controlling the outcome. The minimum remuneration of the student pool was 50 CNY, while that of the professionals' was 200 CNY. The total remuneration per subject was the basic pay plus the motivation amount calculated by experimental currency units. The exchange rate between experimental currency units ("points") and real money was 100 Points = 1 CNY.

*Analysis methods*

Because the data proved not to conform to the normal distribution, they were presented as the median and quartile. And we compared the differences of subjects' choices between the two types of contracts using the Mann–Whitney U test and compared the differences between the three types of subjects using the Kruskal–Wallis (K–W) test. We used the Spearman rank test to analyze the relationship between the distribution

rates (the bidding distribution rates, the final distribution rate, the improvement rate) and the effort level, respectively. In addition, logistic regression was applied to analyze the effect of different factors on the effort level. SPSS 20.0 and all  $p$ -value  $<0.05$  was considered statistically significant.

## Results

### Descriptive analysis of choices

This yielded a total of 480 contracts in the experiment. 479 samples were valid, and 1 sample was invalid due to streaming. 66.39% of the subjects chose flexible contracts, and 33.61% of the subjects chose rigid contracts. After the hospital managers had chosen the type of contracts, the community health service center directors began to bid for contracts. The median of the bidding distribution rate was 18.50%, which of rigid contract was 17.00%, and flexible contract was 20.00%. There was no significant difference between two types of contract ( $p=0.49$ ).

**Table 1** The choices of the bidding distribution rate (%) under two contract types

	Rigid contract		Flexible contract		Total		Mann-Whitney U test	
	Median	Quartile	Median	Quartile	Median	Quartile	Z	p
Undergraduates	15.00	4.75	13.50	5.50	14.25	14.25	-1.70	0.09
Postgraduates	18.25	12.00	20.50	14.00	20.00	20.00	-1.23	0.22
Professionals	25.00	16.25	24.00	5.50	24.50	24.50	-0.44	0.66
Total	17.00	12.00	20.00	13.00	18.50	18.50	-0.69	0.49
Observations (%)	161(33.61)		318(66.39)		479(100.00)		--	

Note: The differences among the three types of subjects are significant in rigid and flexible contracts, respectively ( $p=0.001$ ).

After the nature state was determined, the hospital managers chose the final distribution rate in the flexible contract, the median and quartile ranges of which were 23.00% and 14.00, respectively. As shown in table , professionals chose the highest final distribution rate, and undergraduates chose the lowest final distribution rate. The choices of three groups of subjects differed statistically, with  $p=0.001$ . The final distribution rate was higher than the bidding distribution rate, with an average increase of 3 percentage points. We called it improvement rate. Postgraduates choose the highest rate (4.00), followed by professionals (3.50), and the lowest rate was chosen by undergraduates (2.00). There was a statistically significant difference in the choice among the three groups of subjects, with  $p=0.01$ .

**Table 2** The choices of the final distribution rate (%) and the improvement rate in flexible contracts

	Flexible contract		K-W test	
	Median	Quartile	$\chi^2$	p
The final distribution rate				
Undergraduates	16.00	6.00	--	--
Postgraduates	25.00	14.00	--	--
Professionals	28.00	6.50	--	--
Total	23.00	14.00	85.96	0.001
The improvement rate				
Undergraduates	2.00	3.25	--	--
Postgraduates	4.00	6.00	--	--
Professionals	3.50	6.50	--	--
Total	3.00	4.63	8.91	0.01

The median of the effort level was 9.00, where the rigid contract was 8.00 and the flexible contract was 9.00. However, there was no statistical difference between the two types of contracts ( $p=0.09$ ). In the three groups of subjects, the undergraduate group was significantly higher than were the other two types of subjects.

**Table 3** Subjects' choice of the effort level in two types of contracts

Subjects	Rigid contract		Flexible contract		Total		Mann-Whitney U test	
	Median	Quartile	Median	Quartile	Median	Quartile	Z	p
Undergraduates	10.00	2.00	10.00	1.00	10.00	1.00	-0.39	0.69
Postgraduates	8.00	4.00	8.00	3.00	8.00	3.00	-1.30	0.19
Professionals	8.00	4.00	9.00	3.00	8.00	4.00	-1.18	0.24
Total	8.00	4.00	9.00	3.00	9.00	3.00	-1.69	0.09

Note: The differences among the three types of subjects are significant in Rigid and Flexible contracts, respectively ( $p \leq 0.001$ ).

### Influencing factors of effort level

In this experiment, the distribution proportion of integration profits was the most direct factor influencing the choice of effort level. Therefore, we tested the relationship between the bidding distribution rate, the final distribution rate, the improvement rate, and the effort level. Effort level determines the integration profits. The results showed that the correlation between bidding distribution rate and effort level was unstable in different groups of subjects, so was final distribution rate and effort level. However, there was a significant correlation between the improvement rate and the choice of effort level ( $p \leq 0.05$ ). Increasing the improvement rate will enhance the effort level of community health service centers.

**Table 4** The relationship between the bidding distribution rate, the final distribution rate, the improvement rate, and the effort level

Subjects	The bidding distribution rate		The final distribution rate		The improvement rate	
	r	p	r	p	r	p
Observations	479		318		318	
Undergraduates	0.10	0.30	0.23	<b>0.04</b>	0.35	<b>0.001</b>
Postgraduates	-0.10	0.15	0.07	0.40	0.27	<b>0.001</b>
Professionals	0.14	0.14	0.26	<b>0.02</b>	0.31	<b>0.01</b>
Total	-0.11	<b>0.02</b>	-0.24	0.67	0.19	<b>0.001</b>

In addition to the distribution rate, the subject type, the contract type, the nature state, and the round of the experiment would also influence the choice of effort level, so we conducted a multifactor regression analysis. As can be seen, the effort levels of postgraduates and professionals were lower than undergraduates. The greater improvement rate related to the higher effort level ( $p \leq 0.001$ ). The effort level with a good nature state was higher than bad nature state ( $p \leq 0.001$ ).

**Table 5** Variables' dependence on effort levels within contract types

Independent variable	$\beta$	SE	Wald	df	p	95% C.I. for OR	
						lower	upper
The bidding distribution rate	-0.01	0.01	0.62	1	0.43	-0.04	0.02
The improvement rate	0.13	0.03	20.24	1	<b>0.001</b>	0.07	0.18
The subject type (Reference: undergraduates)							
Postgraduates	-1.50	0.24	37.85	1	<b>0.001</b>	-1.97	-1.02
Professionals	-1.71	0.30	33.56	1	<b>0.001</b>	-2.29	-1.13
Flexible contract (Reference: rigid contract)							
Good nature state (Reference: bad nature state)	0.80	0.22	12.76	1	<b>0.001</b>	0.36	1.23
Round (Reference: first 3 rounds)							
Among 4 rounds	0.14	0.21	0.45	1	0.50	-0.28	0.57
Final three rounds	0.40	0.23	2.97	1	0.09	-0.06	0.86

## Discussion

Hospital managers in our experiment preferred flexible contracts, 66.39% of whom chose flexible contracts. While experimental results obtained by Fehr, Hart, and Zehnder (2011) <sup>[13]</sup> in the commodity markets in a competitive environment showed that 50 percent of subjects in their study chose flexible contracts, and the share of rigid contracts had an upward tendency. The difference of two research results from the degree of uncertainty in different market. The uncertainty in the medical market is more than commodity market, which led hospital managers to prefer flexible contracts for pursuing more choices.

Community health service center directors have shading behavior. Our experimental results show that only 33.47% of subjects chose the highest effort levels 10, which lead to the highest integration profit, Most of the community health center directors were not willing to make the greatest efforts for integration. We can get the similar results from other research<sup>[12,13]</sup>.

Higher improvement rates beyond participants' expectation motivate managers' higher cooperative behavior. The bidding distribution rate is a reference point when the community health service center directors decide the effort level. The relationship between either the bidding distribution rate or the final distribution rate and the effort level was unstable. However, when hospital managers were willing to give a higher improvement rate, community health service center directors were willing to put in more effort, irrespective of either student subjects or professional subjects. Theories of social preferences assume that people are not motivated solely by material self-interest but also take social considerations, especially concerns about fairness, into account <sup>[25]</sup>. The community health service center director does not choose the highest level in full accordance with the pursuit of profit maximization. The results show that community health service center directors would have shading behaviors when they felt the proportion provided by hospital managers was below their expectations. This conforms to the model of Inequity Aversion <sup>[26]</sup>, and the behavior is called "retaliation" in the Reference Point Theory. We hope that our experimental results can prove that this direction is applicable.

Some differences can be observed between student subjects and professionals. We found that the choices of bidding distribution rate, the final distribution rate, and the effort level are different between student subjects and professionals. The higher bidding distribution rate and the final distribution rate of professionals may be related to their work experience. But the significant correlation between the improvement rate and the effort level was similar in all subjects. Besides, a market bubbles' study <sup>[27]</sup> and a medical expenses' payment method study<sup>[15]</sup> both recruited students and professional as subjects, and their results demonstrated that student subjects are similar to professionals in terms of decision-making. Our results show that the correlation of improvement rate and effort level are robust. It is suggested that how to establish an appropriate benefit distribution mechanism should be considered in the process of the VIMDS.

The fact cannot be avoided that there are some limitations in our experimental design. One limitation is a lack of specific information about costs. The quantitative relationship between the cost and the effort level is not specified in the experimental material. Student participants may weaken the role of costs when making choices. Besides, it is unclear how much consolidated profit could be distributed in the future. This is an important factor that influences managers in decision-making. The third limitation is that our experimental design has ignored renegotiation. In reality, the competition between hospitals and community health service centers may result in renegotiation that will influence managers' decisions. Nevertheless, the experiment still reveals the integration mechanism and the results have a significant reference to consummate the integration of medical systems.

## Abbreviation

VIMDS: Vertical integration of medical delivery systems.

## Declarations

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### *Authors' contributions*

Yunque Bo is responsible for experimental design and operation, data analysis and the article writing. Siyu Liu is responsible for the design of the experimental program. Miaojie Qi and Jiyu Cui are responsible for the recruitment of subjects and the collection of experimental data. Youli Han is responsible for the design and quality control of the whole research idea.

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### *Availability of data and material*

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### *Ethics approval and consent to participate*

This study was approved by the medical ethics review board of Capital Medical University, China [Ethical Review Number 2018SY86], and all participants signed a consent form.

### *Consent for publication*

Not applicable.

### *Competing interests*

The authors declare that they have no competing interests.

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## Footnotes

1. The General Office of the State Council on advancing Guidance on the construction of graded clinics State Council issued [2015] No. 70, China
2. We conducted pre-experiments in the previous months, recruiting 40 undergraduates. All subjects were divided into 20 groups. Two subjects interacted in a group of one hospital manager and one center director. The experiment showed that the first quartile of the final distribution rate was 10.00%, the third Quartile was 40.00%, and the highest value was 60.00%.

## Tables

**Table1** The choices of the bidding rate(%) under two contract types

	Rigid contract		Flexible contract		Total		Mann-Whitney U test	
	Median	Quartile	Median	Quartile	Median	Quartile	Z	p
Undergraduates	15.00	4.75	13.50	5.50	14.25	14.25	-1.70	0.09
postgraduates	18.25	12.00	20.50	14.00	20.00	20.00	-1.23	0.22
Professionals	25.00	16.25	24.00	5.50	24.50	24.50	-0.44	0.66
Total	17.00	12.00	20.00	13.00	18.50	18.50	-0.69	0.49
Observations(%)	161(33.61)		318(66.39)		479(100.00)		-	

Note: The differences among the three types of subjects are significant in rigid and flexible contracts, respectively ( $P < 0.001$ ).

**Table 2** The choices of the final rate (%) and the improvement rate in flexible contracts

	Flexible contract		K-W test	
	Median	Quartile	$\chi^2$	$p$
The final rate				
Undergraduates	16.00	6.00	--	--
postgraduates	25.00	14.00	--	--
Professionals	28.00	6.50	--	--
Total	23.00	14.00	85.96	0.001
The improvement rate				
Undergraduates	2.00	3.25	--	--
postgraduates	4.00	6.00	--	--
Professionals	3.50	6.50	--	--
Undergraduates	3.00	4.63	8.91	0.01

**Table 3** Subjects' choice of the effort level in two types of contracts

	Rigid contract		Flexible contract		Total		Mann-Whitney U test	
	Median	Quartile	Median	Quartile	Median	Quartile	Z	$p$
Undergraduates	10.00	2.00	10.00	1.00	10.00	1.00	-0.39	0.69
Postgraduates	8.00	4.00	8.00	3.00	8.00	3.00	-1.30	0.19
Professionals	8.00	4.00	9.00	3.00	8.00	4.00	-1.18	0.24
Total	8.00	4.00	9.00	3.00	9.00	3.00	-1.69	0.09

Note: The differences among the three types of subjects are significant in Rigid and Flexible contracts, respectively ( $p \leq 0.001$ ).

**Table 4** The relationship between the bidding rate, the final rate, the improvement rate and effort level

	The bidding rate		The final rate		The improvement rate	
	$r$	$p$	$r$	$p$	$r$	$p$
Observations	479		318		318	
Undergraduates	0.10	0.30	0.23	<b>0.04</b>	0.35	<b>0.001</b>
postgraduates	-0.10	0.15	0.07	0.40	0.27	<b>0.001</b>
Professionals	0.14	0.14	0.26	<b>0.02</b>	0.31	<b>0.01</b>
Total	-0.11	<b>0.02</b>	-0.24	0.67	0.19	<b>0.001</b>

**Table 5** Variables dependence of effort levels within contract types

Dependent variable							95% C.I. for OR		
	$\beta$	SE	Wald	df	$P$	lower	upper		
The effort level									
Independent variable									
The bidding rate			-0.01	0.01	0.62	1	0.43	-0.04	0.02
The improvement rate			0.13	0.03	20.24	1	<b>0.001</b>	0.07	0.18
The subject type (Reference: undergraduates)									
postgraduates			-1.50	0.24	37.85	1	<b>0.001</b>	-1.97	-1.02
Professionals			-1.71	0.30	33.56	1	<b>0.001</b>	-2.29	-1.13
Flexible contract(Reference: rigid contract)			-0.32	0.22	2.18	1	0.14	-0.75	0.11
Good nature state(Reference: bad nature state)			0.80	0.22	12.76	1	<b>0.001</b>	0.36	1.23
Round (Reference: first 3 rounds)									
Among 4 rounds			0.14	0.21	0.45	1	0.50	-0.28	0.57
final three rounds			0.40	0.23	2.97	1	0.09	-0.06	0.86

## Figures

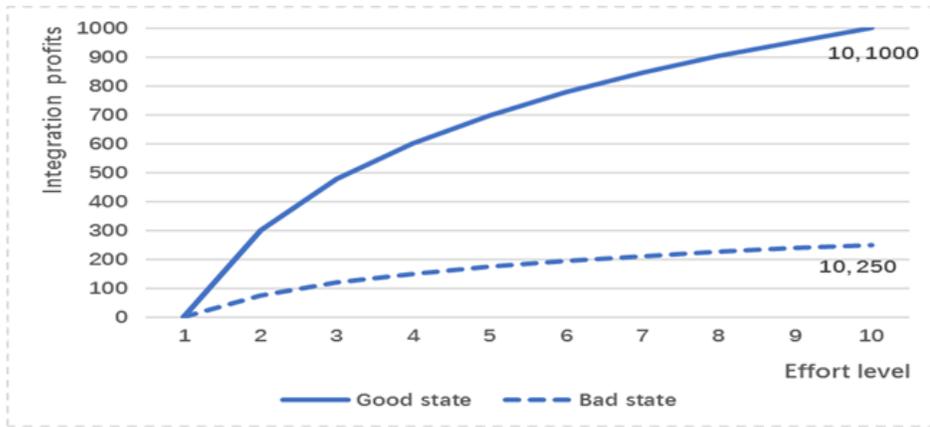


Figure 1

Relationship between effort level and integration profits

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [ExperimentalInstructions.docx](#)