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A Series of Research on Group-Buying Behavior

- Derived from Positive Participation
Externality Effects

賴香菊

中山大學資管系

<http://www.negogo.org>

03/13/2009



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Presentation Agenda

- Incentive Mechanism in Group-Buying
 - ◆ *Comparing the Performance of Group-Buying Models With Different Incentive Mechanisms*
 - ◆ *Empirical Design of Incentive Mechanisms in Group-Buying Auctions: An Experimental Approach*
- Incentive Mechanism and Perceived Fairness
 - ◆ Incentive mechanisms, fairness and participation in online group-buying auctions



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What is Group-Buying?

- To increase bargaining power in order to lower price by aggregating demand.
- Group-shopping, power-shopping, collective shopping, co-buying,...
- Initiator vs. participants
- Uncertainty
 - ◆ Aggregated demand
 - ◆ Price
 - ◆ Time
 - ◆ Success or not



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Research Motivation

- Growth of online group-buying
- Deadlock problem of group-buying
- Positive participation externality effects
 - ◆ existing orders -> new orders
- Price drop effect
 - ◆ Number of orders approaching to the quantity level of the next price tier => more new orders

=> Incentive mechanism to encourage buyers to join group-buying earlier or to buy more




Research Purpose

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To explore if group-buying auction *incentive mechanisms* can effectively encourage participants to *order more or order earlier*, leading *positive participation externality effect* that ultimately increase sales for the seller and lower price for consumers.



Three Proposed Extra Incentive Mechanisms

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- Time-based
- Sequence-based
- Quantity-based

*=> Encourage buyers to join earlier
or to buy more*

Research Framework

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Group-Buying Models

- Traditional
- Time-based
- Quantity-based

Decision Time

- Days for making decision

Order Size

- Size of final order
- Difference b/w final order and planned order

Price

- Perceived value



■ H1: The Average Decision Time Hypothesis

Bidders in a group-buying auction involving the quantity-based incentive mechanism will have the longest average decision time in terms of an absolute measure of time.



- **H2: The Planned Order and Final Order Size Mean Difference Hypothesis**

The mean difference between the planned order size and the final order size for auction participants will differ across the incentive mechanisms of the different group-buying models.



- **H 3: The Group-Buying Auction Participants' Perceived Value Hypothesis**

Compared with group-buying models that offer no incentives, group-buying models with incentive mechanisms give higher perceived value to buyers.



Experimental Design - scenario

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- The subject is asked to play the role in charge of purchasing for a company
- The company currently needs 8 printers and will need another 15 printers in the coming half year.





Experimental Design - price curve

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Size of total orders	Unit price
1-50	6,000
51-100	5,800
101-200	5,400
201- 400	5,200
More than 400	5,000

產品介紹

★ 價格曲線表

交易日期：4/13-4/22止



數量	價格
1-50	6000
51-100	5800
101-200	5400
201-400	5200
400以上	5000

產品介紹

品質可靠、體積輕巧、價格合理，新款 HP LaserJet 1010 雷射印表機最能符合您的商務需求。HP 已經連續 12 年蟬聯北美 PC World 雜誌的 'A+' 品質肯定 - HP 的產品品質, 您最能信賴。

最符合您業務運作所需

HP LaserJet 1015 雷射印表機的體積只有同等級機種的一半，因此在您的桌面還是書櫃等更小的工作空間中都能輕鬆使用。

高品質列印效果

鮮銳、清晰的商務列印。HP LaserJet 1015 雷射印表機採用 HP 解析度增強技術 (Ret)，在光學 600 x 600dpi 下即可提供最高達 1200 dpi 的有效解析度，讓您獲得最優異的專業列印成果。



產品規格



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Experimental Design - subject

- All subjects are part-time graduate students
- 10 days online experiment
- Valid samples

Buyer action			
	Join	Not join	Total
Incentive groups			
Traditional	40	5	45
Time-based	39	5	44
Sequence-based	37	1	38
Quantity-based	43	3	46
Total	159	14	173



Four Different Incentive Mechanisms in Group-Buying

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- **Traditional**
 - ◆ No extra discount
 - **Time-based**
 - ◆ April 13-15, 10% extra discount
 - ◆ April 16-17, 5% extra discount
 - **Sequence-based**
 - ◆ 1st - 5th, 10% extra discount
 - ◆ 6th - 15th, 5% extra discount
 - **Quantity-based**
 - ◆ Order >12, 5% extra discount
 - ◆ Order >20, 10% extra discount
- 

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[實驗說明](#)
[角色扮演](#)

★ 價格曲線表

交易日期：4/13-4/22止

 **訂購單**


HP LaserJet 1015 雷射
印表機

產品市價：6250元

現在馬上加入！錯過可惜！

數量	單價	目前累積購買量
1-50	6000	
51-100	5800	
101-200	5400	
201-400	5200	
401以上	5000	▶ 490

[我要購買](#)
[下次再來](#)
[拒絕交易](#)

現在的累積數量是490個，耶~~超過401了

產品名稱	A型印表機	
購買數量	<input type="text"/>	個
購買者	chris	
送貨地點	高雄市蓮海路70號	
E-mail	m934020014@student.nsysu.edu.tw	
確認訂單		取消訂單

[登出](#)[實驗說明](#)[角色扮演](#)

★ 價格曲線表

交易日期：4/13- 4/22止

數量	單價	目前累積購買量
1-50	6000	
51-100	5800	
101-200	5400	
201-400	5200	
401以上	5000	

凡4/13-4/15加入購買，額外享有九折優惠！
凡4/16-4/17加入購買，額外享有九五折優惠！

[我要購買](#)[下次再來](#)[拒絕交易](#)

現在的累積數量是411個，耶~超過401了

✎ 訂購單

產品名稱	A型印表機	
購買數量	<input type="text"/>	個
購買者	chris	
送貨地點	高雄市蓮海路70號	
E-mail	m934020014@student.nsysu.edu.tw	
	確認訂單	取消訂單

愈早加入折扣愈多囉！



LaserJet 1015
雷射印表機

原市價：6250元

現在馬上加入！錯
不可惜！

 價格曲線表

交易日期：4/13-4/22止

 愈早加入折扣愈多囉!



HP LaserJet 1015 雷射印表機

產品市價：6250元

現在馬上加入！錯過可惜！

數量	單價	目前累積訂購量	目前累積購買人數
1-50	6000		
51-100	5800		
101-200	5400		
201-400	5200		
401以上	5000	448	40

凡前5名購買者，額外享有九折優惠！
凡前6-15名購買者，額外享有九五折優惠！

現在的累積數量是448個，耶~~超過401了

 訂購單

產品名稱	A型印表機
購買數量	<input type="text" value=""/> 個
購買者	chris
送貨地點	高雄市蓮海路70號
E-mail	m934020014@student.nsysu.edu.tw
<input type="button" value="確認訂單"/> <input type="button" value="取消訂單"/>	

[登出](#)[實驗說明](#)[角色扮演](#)

★ 價格曲線表

交易日期：4/13-4/22止

 **訂購單**

 **買愈多愈划算!**



HP LaserJet 1015 雷射印表機

產品市價：6250元

現在馬上加入！錯過可惜！

數量	單價	目前累積購買量
1-50	6000	
51-100	5800	
101-200	5400	
201-400	5200	
401以上	5000	▶ 595

凡購買12台以上，額外享有九五折優惠！
凡購買20台以上，額外享有九折優惠！

[我要購買](#)[下次再來](#)[拒絕交易](#)

現在的累積數量是595個，耶~~超過401了

產品名稱	A型印表機
購買數量	<input type="text"/> 個
購買者	chris
送貨地點	高雄市蓮海路70號
E-mail	m934020014@student.nsysu.edu.tw
確認訂單 取消訂單	



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Basic Results of Experiment

- Quantity-based model got the largest order size

Model	Buyers join the group buying	Buyers not join the group buying	Size of total orders	Final price
Traditional	40	5	462	5000
Time-based	39	5	411	5200
Sequence-based	37	1	422	5000
Quantity-based	43	3	593	5000



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Summary of Individual orders

- Quantity-based model has more larger orders and largest average order size

Order size \ Model	< 12	12~19	≥ 20	Total buyers	Average order size
Traditional	30	3	7	40	11.55
Time-based	31	3	5	39	10.23
Sequence-based	25	5	7	37	11.41
Quantity-based	19	10	14	43	13.79



Summary of the Buyers' Joining Time

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- Time-based model has more buyers joining earlier and has the shortest decision time

Days	Traditional		Time-based		Sequence-based		Quantity-based	
	Buyers joining this day	Accu. buyers	Buyers joining this day	Accu. buyers	Buyers joining this day	Accu. buyers	Buyers joining this day	Accu. buyers
1 st	13	13	10	10	15	15	5	5
2 nd	3	16	8	18	2	17	4	9
3 rd	5	21	7	25	3	20	7	16
4 th	1	22	3	28	0	20	1	17
5 th	0	22	0	28	0	20	7	24
6 th ~ 10 th	18	40	11	39	17	37	19	43
	2.96 days		1.59 days		2.13 days		3.35 days	



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Hypothesis 1 - Decision Time

- *Bidders in a group-buying auction involving the quantity-based incentive mechanism will have the longest average decision time in terms of an absolute measure of time.*

	Mean	Standard deviation	F-statistic
Traditional	2.956 (0.399)	3.618 (0.426)	2.854** (2.827**)
Time-based	1.591 (0.257)	2.499 (0.348)	
Sequence-based	2.132 (0.308)	2.924 (0.401)	
Quantity-based	3.348 (0.482)	3.308 (0.397)	

** significant at 0.05 level



Post Hoc Test: Decision Time

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Incentive (i)	Incentive (j)	Mean Difference (i-J)	Significance according to several <i>post hoc</i> mean difference test		
			Fisher (LSD)	Tamhane	Dunnett
Traditional	Time	1.365	0.041**	0.224	0.220
	Sequence	0.824	0.233	0.829	0.822
	Quantity	-0.392	0.551	0.995	0.995
Time	Traditional	-1.365	0.041**	0.224	0.220
	Sequence	-0.541	0.436	0.940	0.937
	Quantity	-1.757	0.008***	0.033**	0.032**
Sequence	Traditional	-0.824	0.233	0.829	0.822
	Time	0.541	0.436	0.940	0.937
	Quantity	-1.216	0.078*	0.384	0.378
Quantity	Traditional	0.392	0.551	0.995	0.995
	Time	1.757	0.008**	0.033**	0.032**
	Sequence	1.216	0.078*	0.384	0.378



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Hypotheses 2 - Order Size

- *The mean difference between the planned order size and the final order size for auction participants will differ across the incentive mechanisms of the different group-buying models.*

Treatments	Mean	Standard deviation	F-statistic
Traditional	-2.267	8.603	3.650**
Time-based	-3.023	6.389	
Sequence-based	-1.395	7.012	
Quantity-based	1.978	8.694	

* significant at 0.1 level



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Post Hoc Test: Difference of Discrepancy between Planned and Final Order Size

Incentive (<i>i</i>)	Incentive (<i>j</i>)	Mean Difference (<i>i-j</i>)	Significance According to Several <i>Post Hoc</i> Mean Difference Tests		
			Fisher (LSD)	Tamhane	Dunnett
Traditional	Time	0.756	0.647	0.998	0.998
	Sequence	-0.872	0.612	0.997	0.996
	Quantity	-4.245	0.010***	0.122	0.121
Time	Traditional	-0.756	0.647	0.998	0.998
	Sequence	-1.628	0.346	0.859	0.852
	Quantity	-5.001	0.003***	0.015**	0.015**
Sequence	Traditional	0.872	0.612	0.997	0.996
	Time	1.628	0.346	0.859	0.852
	Quantity	-3.373	0.050**	0.276	0.272
Quantity	Traditional	4.245	0.010***	0.122	0.121
	Time	5.001	0.003***	0.015**	0.015**
	Sequence	3.373	0.050**	0.276	0.272



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Hypotheses 3 - Perceived Value

- Compared with group-buying models that offer no incentives, group-buying models with incentive mechanisms give higher perceived value to buyers.

Treatments	Mean	Standard deviation	F-statistic
Traditional	-22.22	358.589	5.798***
Time-based	274.55	464.715	
Sequence-based	151.32	366.570	
Quantity-based	318.48	486.561	

*** significant at 0.01 level



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Post Hoc Test: Perceived Value Difference

Incentive (i)	Incentive (j)	Mean Difference (i-j)	Significance According to Several Post Hoc Mean Difference Tests		
			Fisher (LSD)	Tamhane	Dunnnett
Traditional	Time	-296.768	0.001***	0.007***	0.007***
	Sequence	-173.538	0.066*	0.182	0.180
	Quantity	-340.700	0.000***	0.002***	0.002***
Time	Traditional	296.768	0.001***	0.007***	0.007***
	Sequence	123.230	0.193	0.704	0.696
	Quantity	-43.933	0.625	0.999	0.998
Sequence	Traditional	173.538	0.066*	0.182	0.180
	Time	-123.230	0.193	0.704	0.696
	Quantity	-167.162	0.075*	0.380	0.374
Quantity	Traditional	340.701	0.000***	0.002***	0.002***
	Time	43.933	0.625	0.999	0.998
	Sequence	167.163	0.075*	0.380	0.374

Conclusions

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- Almost every incentive mechanism has resulted in the expected result:
 - ◆ Order more or order earlier
 - ◆ Perceive higher value
- However, it didn't lead positive participation externality effect.



Accumulated Buyers and Orders

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Day No.	Traditional		Time-based		Sequence-based		Quantity-based	
	Accu. Buyers	Accu. Orders	Accu. Buyers	Accu. Orders	Accu. Buyers	Accu. Orders	Accu. Buyers	Accu. Orders
1	14	109	9	98	16	146	5	38
2	19	158	17	168	19	194	12	129
3	24	217	24	233	22	211	16	189
4	24	217	27	260	22	211	22	276
5	25	227	27	260	22	211	25	308
6	26	250	29	271	23	219	27	333
7	27	260	29	271	29	287	30	364



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Why not cause
positive participation
externality effect???



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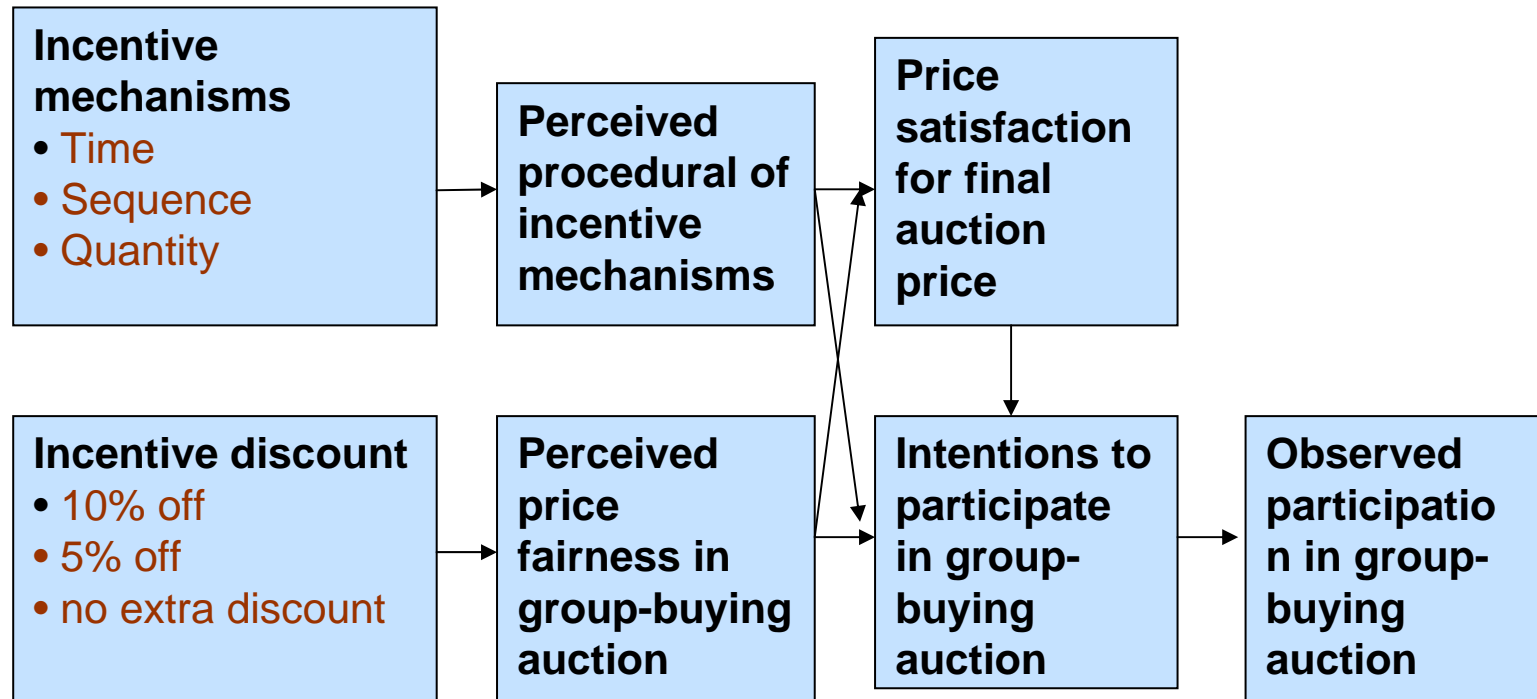
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 - ◆ Comparing the Performance of Group-Buying Models With Different Incentive Mechanisms
 - ◆ Empirical Design of Incentive Mechanisms in Group-Buying Auctions: An Experimental Approach
- Incentive Mechanism and Perceived Fairness
 - ◆ *Incentive mechanisms, fairness and participation in online group-buying auctions*

Research Model

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Hypothesis 1

The Price Discount and Price Fairness Hypothesis

Whether consumers have access to extra price discounts will affect their perceptions of price fairness. The more price discounts to which they have access, the higher will be their perceived price fairness.



Hypothesis 2

The Incentive Mechanisms and Procedural Fairness Hypotheses

Consumers who experience different incentive mechanisms will perceive different levels of procedural fairness. The strength sequence of perceived procedural fairness will be quantity-based, then time-based, and finally sequence-based.



Hypothesis 3

The Perceived Fairness-Price Satisfaction Link

Consumer perceptions of fairness will have a positive effect on their price satisfaction.

- ◆ **Hypothesis 3a (The Procedural Fairness-Price Satisfaction Link Hypothesis).** *The higher procedural fairness that consumers perceive, the higher price satisfaction they will have.*
- ◆ **Hypothesis 3b (The Price Fairness Hypothesis-Price Satisfaction Link Hypothesis).** *The higher price fairness that consumers perceive, the higher price satisfaction they will have.*



Hypothesis 4

The Perceived Fairness-Intention to Purchase Link Hypothesis

Consumer perceptions of fairness will have a positive effect on intention to purchase.

- ◆ **Hypothesis 4a (The Perceived Procedural Fairness-Intention to Purchase Link).** *The higher procedural fairness that consumers perceive, the higher intention to purchase they will have.*
- ◆ **Hypothesis 4b (The Perceived Price Fairness-Intention to Purchase Link Hypothesis).** *The higher price fairness that consumers perceive, the higher intention to purchase they will have.*



Hypothesis 5

The Price Satisfaction-Intention to Purchase Hypothesis

The higher the price satisfaction that a consumer has, the higher will be his or her intention to purchase.



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Hypothesis 6

The Purchase Intention Hypothesis

The higher intention to purchase consumers have, the higher the probability of realizing the purchase behavior they will have.



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Experimental Scenario

你是中山大學的學生，為了促進同學聯誼交流，趁著期中考剛結束，班上準備籌辦聚餐晚會活動，你負責晚會籌畫與採購獎品部份。你已經大致決定好晚會的各项獎品，但還剩有2000元的預算，打算用來購買約120元左右的普獎16份。你正在傷腦筋要買何種獎品時，聽到同學說起白師傅捲心酥相當可口、好吃，因此你覺得白師傅捲心酥或許是可以考慮的普獎之一。

從網站上得知，每罐捲心酥定價為130元，且若購買數量少於30罐時，需要付額外運費150元。很巧地是，你發現學校美食社正在發起白師傅捲心酥的團購活動，如果團購的累積數量高於30罐時，可以免運費；同時，如果累積更多的數量，還可能用更低的價格買到白師傅捲心酥。

因此你決定把白師傅捲心酥當做普獎的可能選擇之一。如果價格合理的話，可以購買數罐當成一部份普獎，不足部份再繼續尋找其他適當的產品。如果價格很便宜的話，就可能購買更多罐當成普獎，甚至你也考慮自掏腰包多買幾罐當做平時的零食。

Experiment Product

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- 白師傅捲心酥(虛擬產品，模仿黑師傅捲心酥)
 - ◆ 經濟能力許可範圍
 - ◆ 有興趣的產品

好吃捲心酥，大家一起買！

說到「白師傅捲心酥」可能很難想像它到底是什麼，簡單說來就是像「脆笛酥」一樣細細長長的，裡頭捲了各式口味的內餡。其實它之所以這麼受歡迎，原因無它 - 用料實在、口感奇佳，再加上不會太過甜膩，讓人忍不住就會一根接一根，如果一邊看電視一邊抱著白師傅，一不小心真的會一口氣就吃掉大半罐！所以，還在等什麼？趕快一起加入團購，享受這個人間美味吧！





Experimental Price Curve

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Price Level	Accumulated Orders	Price
1	1 - 30	NT\$130
2	31 - 60	NT\$125
3	61 - 180	NT\$120
4	181 - 360	NT\$115
5	361 and higher	NT\$110



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Three Incentive Mechanisms

■ Time-based

- ◆ June 5-7, 10% extra discount
- ◆ June 8-9, 5% extra discount

■ Sequence-based

- ◆ 1st - 5th, 10% extra discount
- ◆ 6th - 15th, 5% extra discount

■ Quantity-based

- ◆ Order 10-15, 5% extra discount
- ◆ Order >15, 10% extra discount



Experimental Design

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Incentive mechanism	10% extra discount			5% extra discount			No extra discount		
	Buyer No.	Accu. Q	Day No.	Buyer No.	Accu. Q	Day No.	Buyer No.	Accu. Q	Day No.
Time-based	5	61	2	10	112	4	15	153	6
Sequence-based	5	61	2	10	112	4	15	153	6
Quantity-based	5	61	2	10	112	4	15	153	6



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H1: Effect of Incentive Discounts on Perceived Price Fairness

More discounts

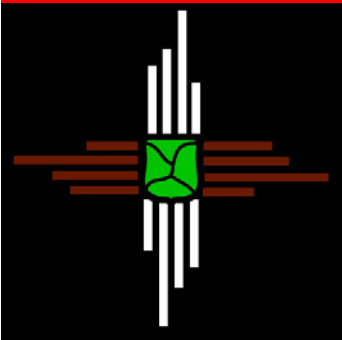
-> Higher perceived price fairness

Test	Sum of Squares	DF	Mean Squared Error	F-Value	p -Value
Between groups	17.495	2	8.748	6.174	0.002***
Within groups	413.727	292	1.417		
Total	431.222	294			



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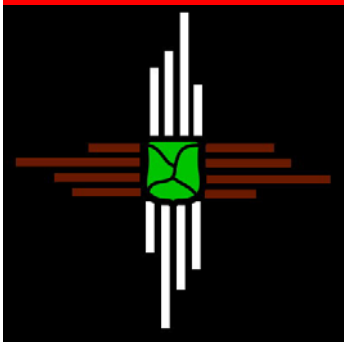
Post Hoc Test of Effects of Incentive Discounts on Perceived Price Fairness

Final Price Discounts (i)	Final Price Discounts (j)	Mean Difference (i-j)	Std. Error	P-Value
10% off	5% off	0.068	0.171	0.925
	No discount	0.542	0.168	0.006***
5% off	10% off	-0.068	0.171	0.925
	No discount	0.474	0.170	0.021**
No discount	10% off	-0.542	0.168	0.006***
	5% off	-0.474	0.170	0.021**



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H2: Effect of Incentive Mechanisms on Perceived Procedural Fairness

Quantity-based > Time-based > Sequence-based

Test	Sum of Squares	DF	Mean Squared Error	F-Value	p-Value
Between groups	6.48	2	3.24	3.198	0.042***
Within groups	295.62	292	1.01		
Total	302.09	294			

Post Hoc Test of Effects of Incentive Mechanisms on Perceived Procedural Fairness

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Incentive Mechanism (i)	Incentive Mechanism (j)	Mean Difference (i-j)	Std. Error	P-Value
Sequence	Time	-0.249	0.144	0.227
	Quantity	-0.350**	0.142	0.050**
Time	Sequence	0.249	0.144	0.227
	Quantity	-0.101	0.144	0.782
Quantity	Sequence	0.350**	0.142	0.050**
	Time	0.101	0.144	0.782



Path Estimation Results

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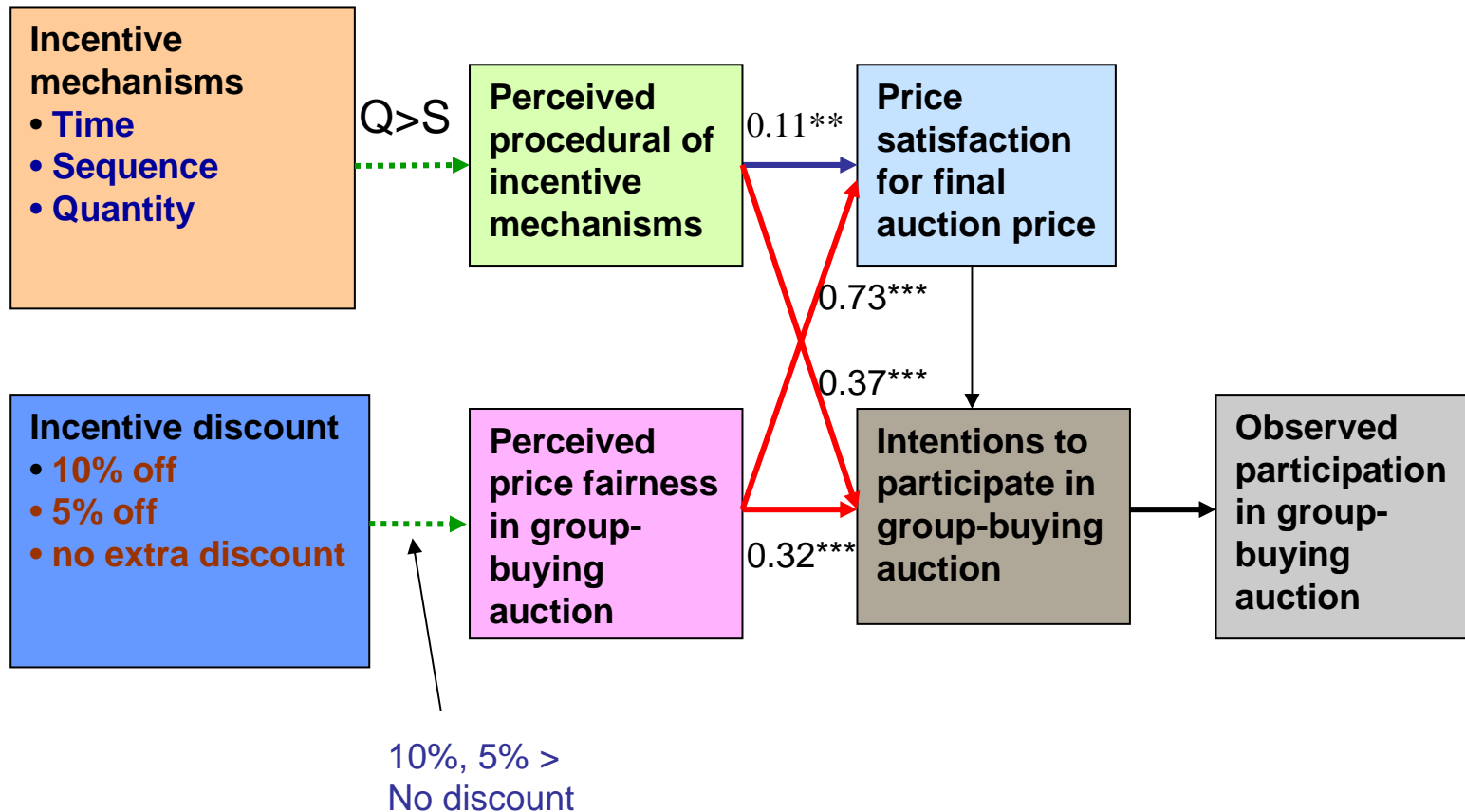
Path	t-Statistic	Estimate	R ²
<i>ProcFairness</i> → <i>PriceSatisf</i>	2.19	0.11 ^{**x}	12.6%
<i>ProcFairness</i> → <i>ParticIntent</i>	5.22	0.37 ^{***}	17.8%
<i>PriceFairness</i> → <i>PriceSatisf</i>	12.12	0.73 ^{***}	23.0%
<i>PriceFairness</i> → <i>ParticIntent</i>	3.29	0.32 ^{***}	13.5%
<i>PriceSatisf</i> → <i>ParticIntent</i>	0.14	0.01 ^{xxx}	16.3%



Summary of Hypotheses Tests

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Thanks!!!