

## **I.Introduction**

No matter where you are in the world, if you have a belief no matter what religion you believe or even you believe in yourself you are surely engaging this problem. Everyone who has a belief surely at least once bought something to confirm his or her belief, whether to keep it at home or wear it with you to make you have something to rely on when you have a trouble.

In Thailand, most of the people believe in Buddhism so in every household, we have Buddha statue and some people even wear Buddha amulet with them. Buddha amulet usually made by clay, iron or silver but it can be price up to over millions of baht. Definitely, the price of Buddha amulet does not reflect the cost of production but rather depend on other factors like the age of the amulet, the creator of it and how much super natural power it has. The supernatural power is not just to bring just good luck to the wearer but also some amulet can even make the wearer bulletproof and this is the factor that the paper will focus. Even nowadays we have less and less war but Buddha amulet is still popular in Thailand because Thai people believe that Buddha amulet would bring luck, money, love and merciful to them( Pongsakornrunsilp & Pusaksrikit, 2012). The rise of Buddha amulet also rise other complementary products industry like Buddha amulet inlaid, Buddha amulet frame, Buddha amulet photographing, Buddha amulet necklace and etc (Intarapanich, 2005).

The supernatural power depend on the age of the Buddha amulet, the popularity of the Thai Buddhist monk who made the amulet, the history of the people who have worn the same Buddha amulet. However, how do buyers know this supernatural power story or information is the problem of this market. If you think that Thai Buddha amulet, is just a small market and is

not worthwhile to solve the problem you might have to rethink. The Thai amulet market is considerable gaining more and more popularity in the country, in 2007 10,000 people stampeded to buy special-edition Jatukam Ramatep amulets in southern Thailand, it is even more than people waiting to buy Iphone6. It was so crowded that one woman was killed and some people were injured (Nat98, 2007). You can see that the scale of Buddhist amulets phenomenon is now so large, despite typically donation going to Buddhist temples are exempt from tax Thai Revenue Department is looking into ways of taxing amulet sales (Bunluesilp, 2007). Therefore, as you can see many people are in the market but the market has just a little information of supernatural power. People can whether gain the information by asking other people, using the internet, magazine, rumor from mouth to mouth or looking at the reward the amulet get. However, the information that they get might be wrong information, even though there is people who know about all correct information but they might never reveal it to the market. The problem is called asymmetric information. Asymmetric information theoretically mean situation where there is imperfect knowledge, in particular it occurs where one party has different information to another. In this case super natural power story is information. This problem exists in many markets in the world. Asymmetric information usually lead to adverse selection where buyer would usually choose the bad product even they prefer the good one. This research is conducted to examine asymmetric information in the real world of Thai Buddha amulet market, whether or not the information in the market is a correct one and whether when the one who have all correct information will reveal it to the market and when they are going to lie.

## **II.Literature review**

Asymmetric information usually comes with Game theory. Game theory is a decision making process of two parties in the market whether it is buyers with sellers or sellers to sellers.

Game theory can be separate in to two types, noncooperative games and cooperative games. For cooperative games firms are colluding because they each gain from information sharing, making they have higher profit from the collusion of information. In cooperative games we have to consider the induce games, balancedness, superadditivity, cores with asymmetric information, Wilson core and the incentives (Allen, 2006). In noncooperative games as players do not collude so the market need mediator, Mediator is the one who collect all of information from the players then tell each player what action should they do. After each player receive the information, their action will depend whether could they believe the mediator or not using mediator past performance. After the action has made then the new round goes again with mediator has to collect the data of each player action again. Normally, Nash equilibrium can be used to solve game theory where each players act according to their best response, however it is in the case of noncooperative games it is not enough. The solutions for this market could be solving by using communication equilibrium, sequential communication equilibrium and predominant communication equilibrium (Myerson, 1984).

Firstly, let see why the existing sources of information is not enough. As the popularity rise so as the demand rise but the Buddha amulet supply has stay constant or even reduce by the Buddha amulet collectors, so there is an excess demand and there is a space for a new business the counterfeit amulet. There are also laws that regulating trade of counterfeit amulet like if the seller intend to misleading customer to buy counterfeit amulet instead of the original one, the seller could be punish by maximum of 3 years of jail and 6,000 baht of fine(Ngarmmeungtheung & Rattanaprijit & Eakjariyakorn,2005). Buddha amulet magazine and Buddha amulet competition also provide all of the information to the buyers of the right characteristic of each original Buddha amulet. However nowadays both Buddha amulet magazine and Buddha amulet

are being more and more commercialized as they are sponsored by some group of people who want their amulet to be in these sources of information where buyers trusted so that seller could further exaggerate supernatural power story of the amulet(Intarapanich, 2005).

To examine whether the Buddha amulet sellers are playing cooperative or noncooperative games we need to look at its structure. In term of barrier to entry for sellers, indeed seller need to be able to identify original or counterfeit amulet ,brand loyalty as consumer would trust the incumbent more and also they need some money in order to rent a space for their shop, advertising and prepare from sunk cost. In term of number of sellers, even though it is true that they are many sellers in the Buddha amulet market but if you are looking a specific edition of Buddha amulet you find about 10-20 shops selling it and if you ask them further, there are shops that are come from a very small number of firms. For number of buyers both online and offline buyers, there will be more 1000 of people walking around the markets or searching through the Buddha amulet shop website. From the study of 4 Buddha amulet markets which are Thraprachan Banglumpho Monthien plaza and [www.uamulet.com](http://www.uamulet.com) we found that most of the firms in the market they know each other well making the collusion easier in term of quantity and price (Intarapanich, 2005). So we can consider that these sellers are playing a cooperative games with superadditivity where as more as sellers are colluding, the information that they can gain would be increase because knowledge would spill over them, even though additional player with no information could worsen the everyone payoff but the sellers could exclude him from the group easily by testing his information. (Allen, 2006).For buyer side they are also trying to play cooperative games with superadditivity where as more as buyer are colluding, the information that they can gain would be increase because knowledge would spill over them but the problem

is that seller also secretly join the buyer group and give fault information so in the end collusion of buyer appear but the information is still not trustable(Allen, 2006).

Buddha amulet market has another interesting characteristics which are there is no market price for each edition of Buddha amulet although the magazine help to signal the price but it will only the range of price but the real price is depend on the willingness of both parties. The price of Thai Buddha amulet reflects the rarity, the flawless, age, popularity and creator of it. The pricing strategies in the industry include cost-plus pricing, imitative pricing, price leadership and speculate and skimming price. For imitative pricing and price leadership are popular pricing strategy as the sellers will know how much did the other sellers sell for the same edition of amulet as they know each other so they will imitate the price. However if the seller has one of the popular Buddha amulet they can set the price by themselves which is called price leadership. Not only the price collusion but also firms help each other to do the business in term of if one of the buyers want a specific edition of Buddha amulet but the firm does not have it can buy the specific Buddha amulet from another firm that they know at relative low price. Then sell to the customer at even higher price this behavior is called “cutting and sharing” Speculate and skimming pricing are the other strategies that have been use in this market as the sellers could heavily advertise about the extra supernatural power that the amulet have so that they can sell at higher price which is call Skimming price. As the consumers see the advertisement and expect that the price of the Buddha amulet would be surely increase in the future so they will buy the Buddha amulet now and when the price rise they could sell which is called Speculate. Of course, there is only a little evidence of price competition, as most of the sellers know each other. However the non-pricing competition, which is advertisement occur (Intarapanich, 2005).

Normally advertisement of Thai Buddha amulet would only show the picture of the amulet and the telephone number that could be contact if anyone is interested. However the story of Buddha amulet creation process and supernatural power story has also be told in advertisement (Kasikoson, 2004). The advertisement in this way has a huge impact in term of stimulating demand making the price of Buddha amulet increase. Most of the people know about the super natural power of the amulet but they never face by themselves. Advertisement can both be informal which is mouth to mouth or formal like from the Buddha amulet magazine. About half of the people they open the Buddha amulet magazine more than 10 times per month. In the advertisement, averagely people are very interested in super natural power story of Buddha amulet and could remember quite well about it. They truly accept that advertisement make they interested in new edition of Buddha amulets, supernatural power in the advertisement make them want to buy the Buddha amulet. Also they truly disagree that advertisement have no effect on their buying behavior. They truly agree that they believe in supernatural power appear in the advertisement. They really disagree that supernatural power is not real. About two third of the people decide to buy a Buddha amulet after receiving information from advertisement (Chaiyakoonwonsan, 2009).

### **III.Methodology**

From studies, we can examine the behavior of sellers and buyers in exchanging information by using Game Theory and discount rate to find the answer of when the information in the market is a truth or lie. In Game theory this paper will use sequential game as seller move first then buyer move accordingly. As this paper is about truth telling process, believe adjustment is another process of decision making so for simplicity this paper will use discontinuous Bayesian, Bayesian equilibrium is when the player could update their belief or information after

players update their believe they will chose their best response(Rasmusen2001).Moreover after the player have update their believe they can either forgive(tit for tat) or never forgive(grim trigger) the liar so for simplicity this paper will use grim trigger strategy when player have detect the lie they will never believe the liar again. Answering the question will make we know that whether when we can trust the information in the market and this not only for Thai Buddha amulet market but it is for all the markets that asymmetric information arise. If the market provides wrong information, this research would further analyze the reason and suggestion to make true information flowing in these markets that would make the problem of adverse selection disappear.

#### **IV.Model**

In this game there are 3 types of players in the games. person A as the one who know all of the information of the games, person B as the one who know partly of the information in the market and person C as the one who know very little about the information in the market. Assuming for simplicity of calculation 10% of people in the market is A given the symbol of  $\alpha$ , 50% of them are B given symbol as  $\beta$  and 40%of them are C given symbol as  $\zeta$ . As buyer A knows all the information in the market, he will always be able to identify the true story and never buy from the people that exaggerate the supernatural story with the high price. For simplicity of calculation assume person B know 70% as A and would value the amulet about 100% or twice as more as compare to what he know more if the exaggerate story of supernatural has been told. While C know 10% as A and would value the amulet 1400% or 14 times more compare to what he know more if the exaggerate story of supernatural has been told. So suppose the amulet price is 10, B would thought it is worth just 7 and with the exaggerate story B would value the amulet as 14, C would think it is worth just 1 and with the exaggerate story C would

value the amulet price as 14. Assume people will buy when utility  $\geq 0$ . Also assume that buyer B would be able to realize the real story of supernatural power within about 1 period, while buyer C would be able to realize the real story of supernatural power within about 2 periods and after they have caught the lie they will never believe the seller again, this is according to discontinuous Bayesian, and grim trigger strategy. This paper also going to focus only long term seller as for short term seller, their dominant strategies is to lie in both periods and leave the market. We could deal with these short term seller by using the duration that they have sell as a signal of them being short term seller and tell the buyers not to buy from them. The most problem that is arise in this market is long term sellers that when they will speak the truth and lie.

### **Pay offs model**

$$\mu = \frac{\Omega}{(1-\sigma)}$$

Given  $\mu$  as his payoff

Given  $\Omega$  as his information

Given  $\sigma$  as his discount factor

Seller would be able to gain  $\Omega$  all the period if he always tell the truth

$$\mu = \zeta\gamma + \beta\gamma$$

Given  $\beta$  as proportion of person B

Given  $\zeta$  as proportion of person C

Given  $\gamma$  as price when the lie has been told

Seller would be able to gain  $\alpha\gamma\beta\gamma$  when he lies in the first time

$$\mu = \alpha \Omega + \zeta \Omega$$

Given  $\alpha$  as proportion of person A

Seller would be able to gain  $(\alpha \Omega + \zeta \Omega)$  from his truth after he lie for once

$$\mu = \zeta \gamma$$

Seller would be able to gain  $\zeta \gamma$  for his second lie

$$\mu = \alpha \Omega$$

Seller would be able to gain  $\alpha \Omega$  from the truth after his second lie

Equation setting in order for sellers to tell the truth all the time his pay off from telling the truth all the time or  $\frac{\Omega}{1-\sigma}$  must be greater than other strategies but less than 1

**Strategy1 Lie consecutively for 2 periods then tell the truth all the time**

**Equation:**  $(\zeta\gamma + \beta\gamma) + (\zeta\gamma)\sigma + \alpha\Omega\frac{\sigma^2}{(1-\sigma)}$

**Strategy2 Tell Truth for  $\infty-3$  periods then lie for 2 periods then tell the truth all the time**

**Equation:**  $\frac{\Omega}{1-\sigma} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-3)} + (\zeta\gamma + \beta\gamma)\sigma^{(\infty-2)} + \zeta\gamma\sigma^{(\infty-1)} + \alpha\Omega\frac{\sigma^{(\infty)}}{(1-\sigma)}$

**So strategy 1= strategy2**

**Proving**

$$\frac{\Omega}{1-\sigma} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-3)} + (\zeta\gamma + \beta\gamma)\sigma^{(\infty-2)} + \zeta\gamma\sigma^{(\infty-1)} + \alpha\Omega\sigma^\infty$$

$$\Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-3)} + (\zeta\gamma + \beta\gamma) \sigma^{(\infty-2)} + \zeta\gamma \sigma^{(\infty-1)} + \alpha \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega\sigma^{(\infty-2)} + \Omega\sigma^{(\infty-1)} + \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)} > (\zeta\gamma + \beta\gamma) \sigma^2 + \zeta\gamma \sigma^{(\infty-1)} + \alpha \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega + \Omega\sigma + \Omega \frac{\sigma^2}{(1-\sigma)} > (\zeta\gamma + \beta\gamma) + \zeta\gamma \sigma + \alpha \Omega \frac{\sigma^2}{(1-\sigma)}$$

$$\frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + \zeta\gamma \sigma + \alpha \Omega \frac{\sigma^2}{(1-\sigma)}$$

**Strategy3 Lie once and tell the truth all the time**

$$\text{Equation: } \frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha \Omega + \zeta \Omega) \frac{\sigma}{(1-\sigma)}$$

**Strategy 4 Tell Truth for  $\infty-2$  periods then lie once then truth all the time**

$$\text{Equation: } \frac{\Omega}{1-\sigma} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-2)} + (\zeta\gamma + \beta\gamma) \sigma^{(\infty-1)} + (\alpha \Omega + \zeta \Omega) \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

**Strategy3=Strategy4**

**Proving**

$$\frac{\Omega}{1-\sigma} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-2)} + (\zeta\gamma + \beta\gamma) \sigma^{(\infty-1)} + (\alpha \Omega + \zeta \Omega) \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-2)} + (\zeta\gamma + \beta\gamma) \sigma^{(\infty-1)} + (\alpha \Omega + \zeta \Omega) \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega\sigma^{(\infty-2)} + \Omega\sigma^{(\infty-1)} + \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)} > (\zeta\gamma + \beta\gamma) \sigma^{(\infty-1)} + (\alpha \Omega + \zeta \Omega) \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega + \Omega \frac{\sigma}{(1-\sigma)} > (\zeta\gamma + \beta\gamma) + (\alpha \Omega + \zeta \Omega) \frac{\sigma}{(1-\sigma)}$$

$$\frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega) \frac{\sigma}{(1-\sigma)}$$

**Strategy5 Lie truth lie then tell truth all the time**

$$\text{Equation: } \frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega) \sigma + \zeta\gamma \sigma^2 + \alpha\Omega \frac{\sigma^3}{1-\sigma}$$

**Strategy6 Tell Truth for  $\infty-4$  periods then lie once then truth then lie then truth all the time**

**Equation:**

$$\frac{\Omega}{1-\sigma} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-4)} + (\zeta\gamma + \beta\gamma) \sigma^{(\infty-3)} + (\alpha\Omega + \zeta\Omega) \sigma^{(\infty-2)} + \zeta\gamma \sigma^{(\infty-1)} + \alpha\Omega \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

**Strategy5=Strategy6**

**Proving**

$$\frac{\Omega}{1-\sigma} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-4)} + (\zeta\gamma + \beta\gamma) \sigma^{(\infty-3)} + (\alpha\Omega + \zeta\Omega) \sigma^{(\infty-2)} + \zeta\gamma \sigma^{(\infty-1)} + \alpha\Omega \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega + \Omega\sigma + \Omega + \dots + \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)} > \Omega + \Omega\sigma + \Omega\sigma^2 + \dots + \Omega\sigma^{(\infty-4)} + (\zeta\gamma + \beta\gamma) \sigma^{(\infty-3)} + \zeta\Omega\sigma^{(\infty-2)} + \zeta\gamma \sigma^{(\infty-1)} + \alpha$$

$$\Omega \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega\sigma^{(\infty-3)} + \Omega\sigma^{(\infty-2)} + \Omega\sigma^{(\infty-1)} + \Omega \frac{\sigma^{(\infty)}}{(1-\sigma)} > (\zeta\gamma + \beta\gamma) \sigma^{(\infty-3)} + (\alpha\Omega + \zeta\Omega) \sigma^{(\infty-2)} + \zeta\gamma \sigma^{(\infty-1)} + \alpha$$

$$\Omega \frac{\sigma^{(\infty)}}{(1-\sigma)}$$

$$\Omega + \Omega\sigma + \Omega\sigma^2 + \Omega\sigma^3 > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega) \sigma + \zeta\gamma \sigma^2 + \alpha\Omega \frac{\sigma^3}{(1-\sigma)}$$

$$\frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega) \sigma + \zeta\gamma \sigma^2 + \alpha\Omega \frac{\sigma^3}{(1-\sigma)}$$

**Strategy7 Lie truth truth lie then tell truth all the time**

**Equation:**

$$\frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega)\sigma + (\alpha\Omega + \zeta\Omega)\sigma^2 + \zeta\gamma\sigma^3 + \alpha\Omega\frac{\sigma^4}{(1-\sigma)}$$

**Strategy8 Lie truth truth truth lie then tell truth all the time**

**Equation:**

$$\frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega)\sigma + (\alpha\Omega + \zeta\Omega)\sigma^2 + (\alpha\Omega + \zeta\Omega)\sigma^3 + \zeta\gamma\sigma^4 + \alpha\Omega\frac{\sigma^5}{(1-\sigma)}$$

**Strategy9 Lie truth for ten periods then lie then tell truth all the time**

**Equation:**

$$\frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega)\sigma + (\alpha\Omega + \zeta\Omega)\sigma^2 + (\alpha\Omega + \zeta\Omega)\sigma^3 + \dots + (\alpha\Omega + \zeta\Omega)\sigma^{10} + \zeta\gamma\sigma^{11} + \alpha\Omega\frac{\sigma^{12}}{(1-\sigma)}$$

**Strategy10 Lie truth for  $\infty-2$  lie then tell truth all the time**

**Equation:**

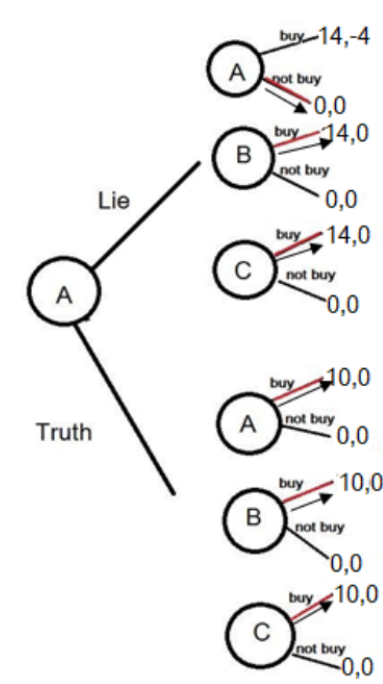
$$\frac{\Omega}{1-\sigma} > (\zeta\gamma + \beta\gamma) + (\alpha\Omega + \zeta\Omega)\sigma + (\alpha\Omega + \zeta\Omega)\sigma^2 + \dots + (\alpha\Omega + \zeta\Omega)\sigma^{(\infty-2)} + \zeta\gamma\sigma^{(\infty-1)} + \alpha\Omega\frac{\sigma^{(\infty)}}{(1-\sigma)}$$

Conclusion as truth period increase between lies discount factor will keep increasing until it is equal to strategy3 where the player lie just once, as lie then telling truth for  $\infty-2$  periods then lie in  $\infty-1$  period, with  $\infty-2$  periods, which the different will be discount by a lot making the two strategies not really difference. Also the result show that no matter how long person A has been speaking the truth then he lie or he lie in the first period it will give him the same payoff, however given a discount rate if he once lie we can surely detect his next lie. Using symbol to

answer making we could apply in to many other case however it is quite hard to interpret the result so this is why the number have been assumed in the beginning of model construction. So in the next part this paper will try to put all numbers that have been assumed in to the model.

## V.Result

### Player A strategies



**Figure 1. Player A strategies**

Seller A has 2 choices, one is to exaggerate the supernatural power and sell at price of 14 which is the price that both buyer B and C willing to buy or do not exaggerate the supernatural power of amulet and sell at the price of what he thought the amulet value is which is 10. As buyer A knows all the information in the market, he will always be able to identify the true story and never buy from the people that exaggerate the supernatural story because they are selling over price by 4 units. So he will buy amulet only when the seller does not exaggerate the

supernatural power of amulet at price of 10. While buyer B and C as they does not know all of the information and from the Chaiyakoonwonsan study, it show that people believe in advertisement and does affect their buying behavior, (Chaiyakoonwonsan, 2009) so they will buy amulet both when the supernatural power story is exaggerate and when it does not. However buyer B would be able to detect the lie in one period while buyer C would be able to detect the lie in two periods

**Conclusion of seller A strategies**

If his discount rate is more than 0.342105263157894 he will tell the truth all the time

If his  $0.34210430077823759519 < \sigma < 0.342105263157894$  he will play strategy 3 or 4 or 10

If his  $0.340399 < \sigma < 0.34210526313676182195$  he will play strategy 9

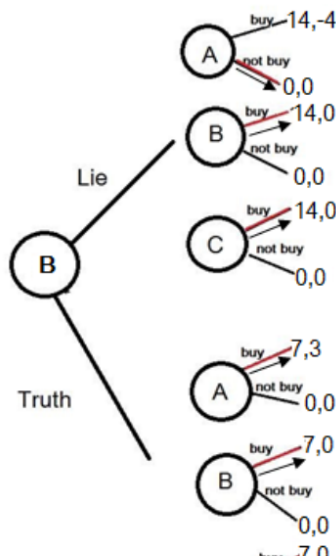
If his  $0.3373 < \sigma < 0.340399$  he will play strategy 8

If his  $0.329084 < \sigma < 0.3373$  he will play strategy 7

If his  $0.308775 < \sigma < 0.329084$  He will play strategy 5 or 6

If his  $\sigma < 0.308775$  he will play strategy 1 or 2

**Player B strategies**



**Figure 2. Player B strategies**

As seller B know just partly if the information, if he exaggerate the super natural power of amulet he would still be able to sell at price of 14, but if he does not he would sell at the price of 7 which is lower than the real price of amulet at 10 because he just know partly about the amulet benefit and not all of it.

Seller B has 2 choices, one is to exaggerate the supernatural power and sell at price of 14 or do not exaggerate the supernatural power of amulet and sell 7. As buyer A knows all the information in the market, he will always be able to identify the true story and never buy from the people that exaggerate the supernatural story. While buyer B and C as they does not know all of the information they will buy amulet both when the supernatural power story is exaggerate and when it does not. So using model above and plugging in the number mentioned above the result is

### **Conclusion of seller B strategies**

If his discount rate is more than 0.615385 he will tell the truth all the time

If his  $0.614908 < \sigma < 0.615385$  will play strategy 3,4 or 10

If his  $0.602971 < \sigma < 0.614908$  he will play strategy 9

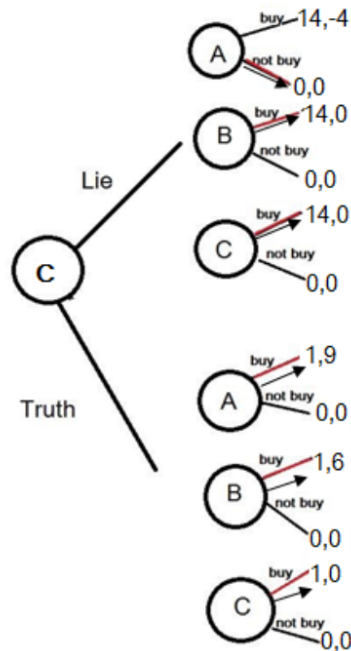
If his  $0.596246 < \sigma < 0.602971$  he will play strategy 8

If his  $0.586214 < \sigma < 0.596246$  he will play strategy 7

If his  $0.571429 < \sigma < 0.586214$  He will play strategy 6,5

If his  $\sigma < 0.571429$  he will play strategy 1 or 2

### Player C strategies



**Figure 3. Player C strategies**

As seller C has no information about supernatural power of the amulet he will sell at the price of 1 which is what he thought 1 is value of the amulet, however if he exaggerate the supernatural power of the amulet he will be able to sell at price of 14

Seller C has 2 choices, one is to exaggerate the supernatural power and sell at price of 14 or do not exaggerate the supernatural power of amulet and sell at price 1. As buyer A knows all the information in the market, he will always be able to identify the true story and never buy from the people that exaggerate the supernatural story While buyer B and C as they does not know all of the information they will buy amulet both when the supernatural power story is exaggerate and when it does not. So after plugging in the number mentioned the result is.

### Conclusion of seller C strategies

If his discount rate is more than 0.958678 he will tell the truth all the time

If his  $0.952101 < \sigma < 0.958678$  will play strategy 2 or 7

If his  $0.950187 < \sigma < 0.952101$  he will play strategy 6

If his  $0.949548 < \sigma < 0.950187$  he will play strategy 5

If his  $0.949548 < \sigma < 0.949548$  he will play strategy 4

If his  $0.949212 < \sigma < 0.949548$  He will play strategy 3

If his  $\sigma < 0.949212$  he will play strategy 1

Comparing seller A B and C, C would always require more discount rate in all of the strategies because speaking the truth for C he would receive only 1 while if he lie he will gain 11.6 more from his first lie and 4.6 more from his second lie while B only gain  $(\gamma + \beta\gamma)$  more from his first lie and -1.4 more from his second lie, while A who need lowest discount rate only gain 2.6 more from his first lie and -4.6 from his second lie.

Given a discount rate at 0.6 Seller A would tell the truth all the time, while Seller B will play strategy 6 as Lie truth for ten periods then lie then tell truth all the time, Seller C will play strategy 1 as Lie consecutively for 2 periods. So this conclude that given the same discount rate A will be more willing to tell the truth compare to B and B will be more willing to tell the truth compare to C

## **VI. Policy implication**

In order for every seller to speak the truth their discount rates have to be higher than 0.958678 so we could have some test where identifying people discount rate by using ascending choice-based test. In ascending Choice-based test, generally present participants with a series of

binary comparisons and identify the point where people change their behavior (Hardisty, Thompson, Krantz, & Weber, 2013). Assuming given in each player type select each strategy equally distributed at 14.28% of that seller type population. Example 14.28% of seller A chooses strategy 1, 14.28% of sellers A choose strategy 2.

Given no policy there will be 13 lies which each lie has over price the amulet by 4 so the total welfare loss is 52 in the market. Seller A truth worth 10 at proportion of 10% so each his truth worth  $10(0.1)=1$  with 7 strategies all of his truth worth 7, while seller B truth worth 7 so at proportion of 50% so each of his truth worth  $7*0.5=3.5$  all of his truth worth 24.5, while seller C truth worth 1 so  $40%*1$  so each of his truth worth 0.4 all of his truth worth 2.8 so the total value of truth in the market is 34.3. At no policy the opportunity cost is decrease 1 value of lies would decrease in 0.65 value of truth.

Policy: Give license to people to sell at discount rate more than 0.958678, with the license there will be no lie in the market but at opportunity cost of 29.4 (34.3-4.9) value of truth, the opportunity cost is decrease 1 value of lies would decrease in 0.56 value of truth. Market will work perfectly and more efficiently but shrink enormously by about 85%. This can be seen that this market is too big; too many people with just little of information are involved in this market.

## **VII. Conclusion**

Lying behavior is depend on seller knowledge about supernatural power and his discount rate, if two players have the same discount rate the one that have higher knowledge will be more likely to speak the truth compare to the one that have lower knowledge. Also given we know player knowledge and his discount rate we might not know when his first lie is going to be in which period but we can surely detect his second lie. We can use the model that have been set

up to answering the question but remind that this model is full of assumption; the first one is of course people or players are rational, the second one is period of lie detection which further market research would provide the real catching period, third is the players which I classified according to level of knowledge which simplify in to just 3 types A,B and C which in reality it could be a thousand types as there are a lot of knowledge level not just up to 10 like I have simplify, fourth the willingness to pay of player B and C when the lie have been told which I assume to be 14 further market research could improve this assumed number, fifth is others factor that could affect the price like the ability for player to detect original and counterfeit market which in this case the model have assumed that with current sources of information this problem is not so large now so the model did not put a factor on account of it, quantity or rarity which also could affect the price, sixth the model is using discontinuous Bayesian and grim trigger strategy where people would adjust their believe that once they have detect the lie they will have the information and never buy from that seller ever again ,which using continuous Bayesian with other strategies like tit for tat would make the research more applicable. Normally the problem of asymmetric information could be alleviated by increase the information however in this case it is hard to increase the information as we cannot be really who has the real information so using discount rate is another way around to alleviate the asymmetric information, with symmetric information there will be no adverse selection which mean that consumer will always get the product that they want which increase society welfare however this will lead to the huge reduction of market size.

## References

- Allen, Beth. 'Market Games with Asymmetric Information': *The Core.Economic Theory* 29 (2006): 465-87. Jstor. Springer.  
<<http://www.jstor.org/stable/pdfplus/25054359.pdf?acceptTC=true>>.
- Bunluesilp, Noppawan. 'Thai Amulet Craze unacceptable Face of Buddhism' .*The Buddhist Channel*. (2007). <<http://www.buddhistchannel.tv/index.php?id=52,4471,0,0,1,0#.VJkc0siEM>>.
- Chaiyakoonwonsan, Chareonchai. 'Impact of advertisement and decision making in buying Buddha amulet of Buddhist people in Bangkok area'. *Thammasat University* 2009
- Hardisty David, Thompson Katherine, Krantzy David, and Weber Elke. 'How to Measure Time Preferences: An Experimental Comparison of Three Methods'. *Judgment and Decision Making* 8 (2013): 236–249. Social Science Research Network.  
<<http://journal.sjdm.org/12/12209/jdm12209.pdf>>.
- Intarapanich, Veerapong. 'Buddha amulet Market and seller behavior analysis: case study of Luang Pu Thuan Wat Changhai Pattani province'. *Thamasat University faculty of economics* (2005)
- Kasikoson,Niti. 'Believe and Value in Thai society'. *TKRI Thammasat university* (2004)
- Ngarmmeungtheung Udom, Rattanaprijit Sahathon and Eakjariyakorn Paithajit . 'Law about buying and selling Buddha amulet'. *Faculty of law asociation Thamamsat University*.(2005)

Myerson, Roger. 'An Introduction to Game Theory'. Kellogg school of management at northwestern university. (1984).

<<http://www.kellogg.northwestern.edu/research/math/papers/623.pdf>>

Nat, 98. 'Jatukham Rammathep Amulets'. Jatukham Rammathep. The Nation, (2007).

<[http://jatukam-th.blogspot.com/2007\\_07\\_01\\_archive.html](http://jatukam-th.blogspot.com/2007_07_01_archive.html)>.

Pongsakornrunsilp, Siwarit, and Theeranuch Pusaksrikit. 'Beliefs and Behaviors of Amulet Thai Consumers'. Prince of Songkla University 3 (2012): 57-92. Latest and Old International Journal Treasury John F Kennedy Library, PSU. Prince of Songkla University. 2014.

<<http://kaekae.oas.psu.ac.th/ojs/psuhsej/viewarticle.php?id=981>>.

Rasmusen, Eric . 'Games And Information : An Introduction To Game Theory'. Malden, Mass. : Blackwell, 2001.