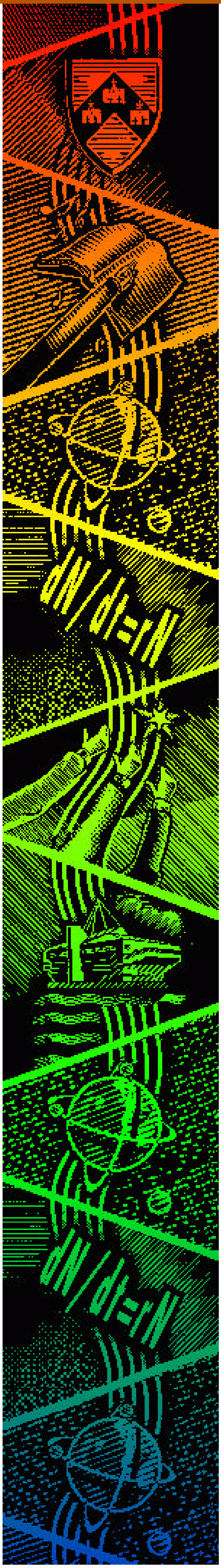

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Two Experiments to Test a Model of Herd Behaviour

by

John Hey and Louise Allsopp

Department of Economics and Related Studies
University of York
Heslington
York, YO10 5DD

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Louise Allsopp*
Department of Economics
University of Birmingham
Edgbaston, Birmingham, B15 2TT
Great Britain
tel. (++44)(0)121-414 6640
fax. (++44)(0)121-414 7377
email:allsoppl@css.bham.ac.uk

John D. Hey
Department of Economics
University of York
Heslington, York, YO1 5DD
Great Britain
tel. (++44)(0)1904-433786
fax. (++44)(0)1904-433759
email:jdh1@york.ac.uk

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Abstract

We carry out two experiments to test a model of herd behaviour based on the work of Banerjee (1992). He shows that herding occurs as a result of people observing the actions of others and using this information in their own decision rule. However, in our experiments herding does not occur as frequently as Banerjee predicts. Contrary to his results, the subjects' behaviour appears to depend on the probabilities of receiving a signal and of this signal being correct. Furthermore, he finds that the pattern of decision making over a number of rounds of the game is volatile whereas we find that decision making is volatile *within* rounds.

*Corresponding author.

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1 Introduction.

The overwhelming impression gained from the expanding literature on herd behaviour is that herding may well be a serious problem. The only experimental work that has investigated any of this theoretical material is that of Anderson and Holt (1997)(which tests the model of Bikhchandani, Hirschleifer and Welch (1992)) confirms this general impression.

The framework used in most of this literature is that of a sequential model in which agents receive some kind of information signal and then must take a decision based on that signal. However, the model of Bikhchandani, Hirschleifer and Welch represents a special case in which the subjects face a simple choice between two possible decisions and always receive a signal - which takes a particularly simple (binary) form. In contrast, our experiment provides a richer environment in which to examine herd behaviour. The model that we test includes the possibility that people *do not* receive a signal. In addition, there is an infinite set of possible decisions.

The experiment is based on the model developed by Banerjee (1992). This model provides the motivation for a great deal of the more recent literature on informational cascades and presents some very powerful results. First, the probabilities of receiving a signal, and of that signal indicating the correct decision, do not influence the optimal strategy. This seems counter intuitive since one would assume that these probabilities would play a role in an individual's choice of action. Second, individual's are privately optimising; however, the result is socially suboptimal. Third, herds set in at an early stage in this model: if the first two individuals follow the same course of action then a herd cannot be broken. Finally, the probability of an incorrect herd may be high: this *does* depend on the values of receiving a signal and of that signal being correct.

In addition to performing two experiments to test the validity of this model, we stress an important theoretical point. Our investigation reveals that a particular assumption of his model which he claims merely reduces the probability of herding is crucial to the solution of the model. The Banerjee strategy produces an elegant result in which the decision rule remains the same regardless of (a) an individual's position in the sequence, (b) his probability of receiving a signal and (c) the probability of that signal being correct. We show that the removal of this seemingly innocuous assumption generates an optimal decision rule which differs according to each of these factors.

The aim of this paper is to test the null hypothesis that individuals behave according to the strategy given by Banerjee. This is important since if they *do* behave in this manner, this implies a large degree of herding. The paper is set out as follows. First, we describe Banerjee's model and specify the optimal strategy. We then illustrate the importance of the assumption referred to in the paragraph above in the context of his model. We then describe our experimental design which had two objectives: first, to see whether subjects did indeed follow Banerjee's strategy; second, to see if changes in the underlying parameters of the model affected behaviour in the way indicated by that strategy. We then analyse the results from each of the two experiments and draw conclusions.

2 Model.

There is a 'winning number' which lies between 0 and 1. Subjects must try and discover this winning number. Subjects who do, gain a prize, z. All other subjects receive a payment of 0. The population consists of N people who move sequentially. The order in which they move is determined exogenously. If an individual is informed, he receives a signal. This occurs with probability α. This signal is a number between 0 and 1. This signal coincides with the winning number with probability β. With probability $1 - \beta$ this signal is a uniformly generated random number between 0 and 1. To solve the model, Banerjee analyses a 'Bayesian-Nash equilibrium' [1]. An important property of this is that the equilibrium decision rule is the same for all parameter values.

Banerjee uses three assumptions.[2] These are as follows:

[1] This is Banerjee's terminology. However, we shall henceforth refer to this as the 'optimal strategy' since the game is a sequential one. Individuals base their decisions on the actions of previous players plus their own signal.

[2] He states that 'the relevance of these assumptions will become clear in the appropriate

Assumption A - If a player has received no signal and all other previous player have chosen 0, he must also choose 0.

Assumption B - If a player is indifferent between following his own signal and another player's choice, he will follow his own signal.

Assumption C - If a player is indifferent between following more than one of the previous players, he will follow the one with the highest signal.

It should be noted that Assumption A is of a different type to that of Assumptions B and C: in the context of an experiment, B and C are impossible to impose since it is not possible to establish whether individuals are indifferent between options. Therefore, these have not been included in our experiment. However, assumption A can be implemented: in our first experiment, we include assumption A while in the second experiment, assumption A is dropped and subjects are allowed to make a guess at the winning option.

Given assumptions A, B and C, Banerjee offers a solution to the model in the form of an optimal decision rule for each individual. This optimal strategy is adopted by each individual irrespective of their order of play. This is a particularly interesting point since the optimal strategy is the same for each player despite the fact that they move sequentially.

The first player follows his own signal if he receives one. If he does not get a signal, he is obliged by assumption A to choose $i = 0$. The subsequent individuals will adopt the following rules. They will follow their own signals either if and only if:

(i) the signal matches that of another player or if this does not hold

(ii) no option has been chosen by more than one person apart from $i = 0$.

If a player receives a signal which does not match the action of a previous player, he will choose the option chosen by more than one of the individuals. If the option with the highest value of i has been chosen by more than one

context. It should also be possible to see that each of the assumptions is made to minimise the possibility of herding.'

person, he will choose this option providing that no other option has been chosen by more than one person and no one else's choice matches his own signal.

If the player does not receive a signal, then he will choose $i = 0$, due to assumption A, if everyone else has chosen this. If some option has been chosen by more than one person, then he will also choose this. However, if no option has been chosen more frequently than any of the others, he will choose the one with the highest value of i.

A crucial point to note here is that, according to his rule, the decision rule forming the optimal strategy holds irrespective of the values of α and β. If Assumption A is removed, this feature no longer holds.

3 Importance of Assumption A.

The crucial difference between the model including assumption A and the model omitting assumption A is that the same sequence of signals will generate different sequences of observations. In discussing the experiment, we refer to assumption A as *Rule A*. The reason is that in the first experiment, this assumption is imposed whereas in the second experiment it is omitted. A player bases his action on the signal he receives and the actions of the previous players. Thus, his own action depends on whether the rule is imposed or omitted. We demonstrate this through a table which analyses the possible decisions facing player 3 in the sequence.

In table 1, we have shown each possible combination of signals received by each of the three players. These are denoted by **bold type** and are given in the first three columns.

The signals of players 1 and 2 generate actions which player 3 observes. He observes their actions but not the signals which they have received. Columns 4 and 5 illustrate the actions of players 1 and 2 when assumption A is included. The sixth column shows player 3's optimal action given the signal he has received plus the observations he makes of previous players' decisions. Actions of players are denoted by *italics*.

Columns 7 and 8 give the actions of players 1 and 2 when assumption A is omitted. Player 3 bases his decision on his observations and his own signal if he receives one. The result is seen in the ninth column.

Signals Received			**Actions With Assumption A**		**Action of Player 3**	**Actions Without Assumption A**		**Action of Player 3**
Player 1	Player 2	Player 3	Player 1	Player 2		Player 1	Player 2	
0	**x**	**x**	*0*	x	x	y	x	x
0	**y**	**x**	*0*	y	x	z	y	x
x	**x**	**x**	x	x	x	x	x	x
x	**0**	**x**	x	x	x	x	x	x
y	**z**	**x**	y	z	x	y	z	x
x	**0**	**0**	x	x	x	x	x	x
y	**x**	**x**	y	x	x	y	x	x
x	**y**	**x**	x	y	x	x	y	x
x	**x**	**0**	x	x	x	x	x	x
0	**0**	**0**	*0*	*0*	*0*	x	x	x
0	**x**	**0**	*0*	x	x	y	x	x
x	**y**	**0**	x	y	*Use Ass. C*	x	y	y
0	**0**	**x**	*0*	*0*	x	y	y	*see text*
y	**0**	**x**	y	y	y	y	y	*see text*
y	**y**	**x**	y	y	y	y	y	*see text*

Table 1: Importance of Assumption A

The main point to note is that player 3's optimal decision differs considerably when the assumption is removed. In the first nine rows of this table, we show the sequences of signals for which the optimal strategy of player 3 is the same irrespective of assumption A. However, in rows 10 to 15, the optimal strategy *is* dependent on assumption A. In the last 3 rows, the action of player 3 depends on the relative sizes of α and β.[3]

Consequently, problems emerge in the lower half of the decision tree. The fact that a player is allowed to make a guess at the winning option when he has no signal reduces the information available to others. We have shown that, as a result, player 3's decision becomes more complex and depends on the relative sizes of α and β. This has repercussions for the decisions of players later in the sequence. They will use the sizes of α and β to arrive at their own optimal decision. Furthermore, they will assume that previous players have also used these values in *their* decision rules and build this into their own decision. It follows that there is no single strategy which applies to each player irrespective of his position in the sequence.

4 Experimental Design.

The purpose of the experiment was two-fold: first, to test whether subjects follow the Banerjee strategy; second, to investigate whether their behaviour responds appropriately to changes in the parameters of the model. Accordingly we needed to select appropriate parameter values. In particular we needed to choose a value for n sufficiently great to observe the herding predicted by Banerjee's model, and values for α and β which would enable us to discern movements in subjects behaviour. A simulation revealed that herding would set in almost certainly under Banerjee's strategy with a value of n equal to 7. Moreover, this simulation showed that value of α and of β of 3/4 and 1/4 should be sufficient to induce significant changes in behaviour. Accordingly we had four parameter sets, all with n equal to 7, composed of each of the two values of α combined with each of the two values of β. We

[3]Proofs are available from the authors.

then adjusted the prize accordingly so that the expected payment to each subject in each session would be £7.

We presented each subject in turn with 16 bags. k_1 of these bags contained 10 blank discs; k_2 contained 10 discs all numbered with the winning number; and k_3 contained 10 discs numbered from 1 to 10. The values of k_1, k_2 and k_3 depended upon the desired values for α and β.

4.1 Experimental Procedure.

We used a different set of subjects for each of the 4 sessions of 10 rounds. At the start of each session, they were brought into the room and were seated between large dividing screens to prevent communication during the experiment. We handed each subject written instructions[4] (as seen in the appendix) and also read these aloud so as to ensure that each group received the same information and understood what was expected of them.

The order in which the subjects moved was chosen at random. We asked each of them in turn to select one of the 16 bags available[5]. From this, they drew a disc which was either blank or had a number between 1 and 10 printed on it. They were instructed not to reveal this information to the other subjects. We made a note of the disc drawn for future reference. We then asked them for their guess at the winning option. We wrote this on the board at the front of the room for all to see and then approached the next subject.

When all 7 subjects had chosen the number they believed to be the correct option, we announced the winning option and awarded the cash prizes. The process was then repeated for another 9 rounds after which the session was completed. For each session the subjects were informed of the number of bags containing the winning option, the numbers 1 to 10 and the blank discs.

[4]In the experiment omitting Rule A, the paragraph placing restrictions on subjects if they chose a blank disc from the bag was dropped.

[5]without, of course, knowing which bags the previous subjects had selected

5 Results.

Firstly, our experiment revealed that herding did not occur as frequently as the theory predicted under certain sets of parameter values for the experiment with rule A. When this rule was not imposed, the degree of herding was consistent with and sometimes exceeded that predicted by the Banerjee simulation. Secondly, contrary to Banerjee's theory, the subjects appeared to use the values of α and β in formulating their decision.

The results of each of the sessions are reported in the appendix. They are laid out so as to show the number drawn by each of the subjects together with their corresponding choice. In the final column, the winning option is stated. In the first instance, we will set out the results for the experiment in which Banerjee's rule A was enforced. We will then compare these results with the experiment in which this rule was relaxed.

5.1 Experiment Including Rule A.

In examining the results from each experiment we distinguish between *average* behaviour in each session and *specific* behaviour in each position of play. The tables summarising specific behaviour are not reported in this paper but may be obtained from the authors. Those tables showing average behaviour can be found in the appendix.[6]

Table 4 illustrates the actual and predicted proportions of true and false herds and also the proportions of true and false *runs* in the first experiment. For each of these predicted proportions we have included a confidence interval.[7] Under Banerjee's definition, a herd occurs when 2 subjects choose the same action. However, while we find that herds started, inspection of the

[6]In each session, the actual number of signals received fell within the 95% confidence interval for that which was predicted. In examining the actual number of *correct* signals received, all but those of session 3 lay within the 95% interval. This is as one would expect.

[7]Note that the n value equals 10 since we are considering the number of rounds in each session. This implies that np and $n(1-p)$ are smaller than 5 and hence the proportions cannot be approximated by a normal distribution. We have included this measure in the absence of a suitable alternative but the results must be viewed with a degree of caution. Caution should also be exercised in that some of our analysis assumes independence between observations, which is almost certainly not the case.

data in the appendix reveals that these were frequently broken. Therefore, we distinguish between a 'run' and a 'herd'. If 2 or more consecutive subjects follow the same number but this is subsequently broken by another subject choosing a different option, we denote this as a 'run'. However, if this is not broken we describe this as a 'herd'.

In session 1, there are no true herds but one true run. This is not significantly different from that which the theory predicts. However, there were significantly fewer *false* herds setting in than the theory predicted. We found that the subjects displayed a much stronger tendency to follow their individual signals or appeared to choose randomly.

In session 2, the number of true herds was smaller than predicted by Banerjee. However, there were a number of true *runs* occurring. The same pattern emerged for the number of false herds. There was just one false herd in this session. However, there were three false runs.

In session 3, the proportion of true herds was close to that predicted by Banerjee. There were also two runs occurring. However, the number of false herds was significantly lower than predicted. However, there were a number of false runs emerging. If these had not been broken, the total number of false herds would have been close to that predicted by the Banerjee strategy.

In session 4, the actual proportions of true and false herds corresponds to that predicted by the Banerjee rule with just one true run occurring.

In table 2, we report the proportion of rounds in each session which were compatible with the Banerjee strategy. This proves to be very revealing since his strategy is only closely followed in one of the four sessions. This would suggest that in the other sessions, subjects are adopting an alternative approach.

In analysing the specific behaviour of subjects, we examine their actions conditional on whether they receive a signal. When α and β both equal 0.25, subjects appear to follow their own signal if they get one. However, in session 2, with β equal to 0.75, there were 3 occasions in which subjects abandoned their own signal. In session 3, the strategy appeared to change according to the position of play. For earlier players in the rounds, there was a tendency to follow their own signal. However, later players abandoned their own signal.

In session 4, subjects playing early in the round had a tendency to follow their own signal. However, later subjects were more willing to abandon their own signal if it did not match that of an existing herd.

For those subjects not receiving a signal, there was also a particular pattern of behaviour emerging. In session 1, subjects appeared to choose randomly more often than following the most frequently chosen number. This occurred for each position of play. In session 2, there was also a strong tendency to choose a number which had not already been chosen. However, for later rounds, subjects were equally likely to follow the most frequently chosen number. For sessions 3 and 4 there were very few occasions in which a blank disc was drawn and the majority of subjects followed the most frequently chosen number.

5.2 Experiment Without Rule A.

Table 5 shows the actual and predicted proportions of true and false herds for the experiment plus the actual proportion of true and false runs.[8] Firstly, it is important to compare the actual results with those predicted. It is also worthwhile comparing these results with those of the original experiment since this shows the effect of omitting rule A.

In the first session, the predicted proportion of false herds exceeded that of the original Banerjee strategy with assumption A. Conversely, the predicted proportion of true herds was less than under the original Banerjee strategy. This implies that the removal of assumption A leads to an increase in the proportion of incorrect herds when α and β are small. In this session, the number of herds was close to that which was predicted. However, there were more runs occurring than under the original Banerjee rule.

In session 2, the predicted proportion of false herds also exceeded that of the original Banerjee strategy with assumption A. Again, the predicted proportion of true herds was less than under the original Banerjee strategy. The main feature of this session, however, was the large number of runs. If

[8] In each session, the total number of signals received lay within the 95% confidence interval. However, in session 3, the actual number of *correct* signals lay slightly outside the confidence interval. Those of the other sessions fell within the confidence interval.

these had not been broken, they would have generated a far greater number of herds than predicted. This confirms Banerjee's argument that assumption A reduces the possibility of herding.

In session 3, herding was consistent with that which was predicted. However, there was a large proportion of false runs. If these had not been broken they would have created a proportion of false herds significantly greater than predicted.

In session 4, herding was close to that predicted but this time there was a large proportion of *true* runs.

Table 3 shows the proportion of rounds in which the Banerjee strategy was played throughout. The main point to note there is that his strategy was played in only a small proportion of rounds. Also note how this compares with the original experiment. Session 2 is the same for each experiment and session 1 is very close. However, the Banerjee strategy is played much more frequently for sessions 3 and 4 under the original experiment with rule A. The probability of receiving a signal here is large at 0.75. Therefore, it is less likely that subjects earlier in the experiment are drawing blank discs and thus generating false herds through guesswork.

We now summarise the behaviour of those subjects receiving a signal. In session 1 with the exception of one person, all subjects followed their own signal if they received one. This is also a feature of session 2. For session 3, earlier players favour their own signal while players later in the sequence are more willing to abandon their own signal. In session 4, there is once again a strong tendency to follow one's own signal.

We now consider those subjects who do not receive a signal. In session 1, we cannot find an observable pattern emerging. Players appear to alternate between following the most frequently chosen number, another chosen number and appearing to choose randomly. However, there is a pattern emerging in session 2 in that there is an increasing tendency to follow the most frequently chosen number as the session progresses.

In sessions 3 and 4 there are only a few subjects who do not receive a signal so there is only a small amount of data available here. In session 3, players 3, 6 and 7 predominantly follow the most frequently chosen number.

Player 2 only does this 50% of the time and appears to choose randomly for the remaining 50%. Player 4 displays a tendency to choose randomly rather then follow the most frequently chosen number. In session 4, subjects always follow the most frequently chosen option when they do not receive a signal.

6 Conclusion.

Our concluding comments fall into two categories. Firstly there are the implications of our theoretical findings. We show that, without assumption A the whole decision making process becomes dependent on (a) the position in the sequence and (b) the probabilities, α and β.

In terms of future lines of research, this implies the ambitious task of solving the model without assumption A.

The main result of our experiment with rule A was that herding occurred less frequently than predicted by the Banerjee framework. The behaviour of subjects was far more individual than the theory suggested with subjects using the information on α and β and also their position of play in the rounds to formulate their decisions. In his model, Banerjee found that there was tremendous volatility in the pattern of decision making over a number of plays of the game. This was because the onset of herding and its direction depended upon the signal received by the first few individuals. However, we found that this volatility occurred *within* rather than *between* rounds. When a run set in, it did not necessarily continue. With certain parameter values, players were inclined to break the run using either their own signal or by appearing to choose randomly.

In the experiment without rule A, herding was more prevalent than under the original experiment with assumption A. Significantly, we also witnessed a large number of runs which were subsequently broken. These would indicate a willingness on the part of some subjects to follow a herd and then the opposite behaviour from other subjects breaking that run. These appeared to occur regardless of the values of α and β and generated volatility within rather than between rounds.

In this experiment, subjects were even less inclined to follow the Banerjee strategy. In sessions 1 and 2, there was a strong tendency to apparently choose randomly rather than the most frequently chosen number when no signal was received. Given this type of behaviour, it would be revealing to circulate a questionnaire to each subject following each session asking them about their strategies in a future experiment to test herding.

A Instructions for the Subjects

Welcome to the Experiment!

Firstly, you will notice that you have been partitioned off from the other players. There is nothing sinister here: one of the few rules that I am imposing is that you do not communicate with the others.

- I will be running the experiment 10 times and will be awarding a cash prize of £4 to each player who chooses the winning number in each round. The aim of the exercise is to find this winning number.
- For each game that will be played, the winning number and the order in which you play have been chosen at random. I put discs numbered 1 to 10 into a bag and picked a disc from the bag. This is the winning number for the first game. I then replaced the disc and repeated this to determine the winning numbers for the other 9 rounds.
- I will present each of you, in turn, with 16 bags and you will be asked to pick one. The bags all look the same but their contents differ. Each contains 10 discs. Twelve bags contain blank discs. Three of the bags contain the numbers 1 to 10. The other contains 10 discs with the winning number.
- You will then draw a number from your chosen bag. Do not disclose this to anyone.
- I will then ask you to write your chosen number on my clip board. This may or may not be the number appearing on your disc. You are not obliged to stick with the number which is written on your disc if you think you know better.
- The only rule I make regarding your choice of number is that if you pick a blank disc from the bag, you are not allowed to choose a number if:

  (a) You are the first person to move in the game or

  (b) No one who has moved before you has chosen a number.

- I will then write your chosen number on the flip chart for the other players to see.
- When all the players have chosen the number which they think is the winner, I will announce the winning number and award the cash prizes. **Good Luck!**

B Data from the Experiment Including Rule A

B.1 Session 1 - α and β equal 0.25

Nos Picked From Bags							Nos Chosen By Subjects							Winning Option
-	10	-	-	-	-	-	-	10	6	3	7	6	4	10
-	-	-	2	-	-	1	-	-	-	6	6	8	1	1
-	4	-	4	2	-	4	-	4	4	6	2	4	4	10
-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
-	-	8	-	-	-	-	-	-	8	7	2	5	6	5
-	-	-	-	-	3	-	-	-	-	-	-	3	9	8
-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
-	-	-	-	-	4	2	-	-	-	-	-	4	2	5
-	-	2	-	2	-	-	-	-	2	2	2	9	3	2
-	-	-	-	-	6	-	-	-	-	-	-	6	7	7

B.2 Session 2 - α equals 0.25 and β equals 0.75

Nos Picked From Bags							Nos Chosen By Subjects							Winning Option
-	10	-	-	-	-	-	-	10	4	6	6	7	5	10
-	2	-	2	-	2	-	-	3	5	2	3	3	5	2
-	-	-	-	3	-	3	-	-	-	-	3	4	3	3
-	9	9	-	-	-	-	-	9	9	9	8	9	6	9
-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
-	-	9	9	6	-	9	-	-	9	9	6	5	9	9
-	10	-	-	-	-	-	-	10	8	6	10	9	10	10
-	4	9	-	-	-	9	-	4	9	8	4	4	4	9
-	-	-	-	3	-	3	-	-	-	-	3	3	3	3
6	6	-	-	-	-	-	6	6	6	6	6	6	6	6

B.3 Session 3 - α equals 0.75 and β equals 0.25

Nos Picked From Bags							**Nos Chosen By Subjects**							**Winning Option**
4	10	8	-	3	8	-	6	10	6	3	7	4	4	9
9	3	4	3	-	-	10	3	3	3	9	4	3	10	3
4	10	8	8	-	1	-	4	4	8	8	8	8	8	8
-	2	4	-	-	7	-	-	7	4	4	4	7	4	7
3	1	4	1	1	1	9	1	1	4	1	1	1	9	1
1	5	5	-	5	-	5	1	5	5	5	5	5	5	5
2	2	2	-	-	7	10	2	2	2	2	2	2	2	2
7	7	7	7	7	7	3	7	7	7	7	7	7	7	7
9	6	10	-	-	4	6	9	6	9	9	9	9	9	1
8	-	8	7	-	-	-	8	8	8	8	8	8	4	4

B.4 Session 4 - α and β equal 0.75

Nos Picked From Bags							**Nos Chosen By Subjects**							**Winning Option**
5	5	2	5	5	3	5	5	5	2	5	4	5	5	5
9	9	2	2	9	9	-	9	9	9	9	9	9	9	9
4	1	5	5	-	5	3	4	1	5	5	5	5	5	5
-	3	3	-	-	3	-	-	3	3	3	3	3	3	3
9	1	9	1	9	10	9	9	1	9	1	9	9	9	9
10	10	10	-	10	10	10	10	10	10	10	10	10	10	10
-	10	-	10	5	1	7	-	10	10	10	10	10	10	5
2	3	-	2	10	2	6	2	3	2	2	2	2	2	2
4	4	4	4	5	4	6	4	4	4	4	4	4	4	4
3	3	3	10	3	-	2	3	3	3	3	3	3	3	3

C Data from the Experiment Without Rule A

C.1 Session 1 - α and β equal 0.25

Nos Picked From Bags							Nos Chosen By Subjects							Winning Option
2	2	-	-	3	10	-	2	2	3	3	3	10	7	2
3	-	-	-	-	-	-	3	8	9	8	9	3	8	3
-	-	-	-	-	-	-	5	5	8	5	8	9	8	4
8	8	5	-	-	-	-	8	8	5	5	5	8	5	7
-	-	-	-	-	3	-	4	1	1	9	8	3	5	3
7	10	5	-	6	-	5	7	10	5	5	6	5	5	8
-	-	-	-	-	6	-	5	5	5	5	9	6	6	10
-	-	-	-	-	-	-	1	6	5	9	9	1	9	4
-	-	-	-	-	-	7	5	6	8	10	7	6	7	7
-	9	6	-	-	9	-	3	9	9	9	5	9	5	9

C.2 Session 2 - α equals 0.25 and β equals 0.75

Nos Picked From Bags							Nos Chosen By Subjects							Winning Option
-	-	3	-	3	-	-	6	7	3	4	3	5	3	3
-	-	10	8	-	8	-	6	6	6	8	6	8	6	8
-	-	-	-	1	-	1	4	4	7	4	4	4	4	1
-	6	-	2	2	2	2	6	6	2	2	2	2	2	2
-	-	-	-	2	2	-	6	6	7	6	6	6	6	2
6	-	-	3	-	-	8	6	6	6	6	6	6	8	7
-	-	-	9	-	-	-	6	4	6	9	9	4	9	9
-	-	-	-	-	-	-	4	6	6	6	6	6	6	7
8	-	-	8	-	8	8	8	6	6	8	8	8	8	8
-	-	-	-	-	2	-	2	2	2	2	2	2	2	2

C.3 Session 3 - α equals 0.75 and β equals 0.25

Nos Picked From Bags							Nos Chosen By Subjects							Winning Option
9	5	5	9	5	9	4	9	5	5	9	6	9	4	9
10	4	-	-	8	5	-	7	4	7	8	8	7	8	10
9	2	8	-	3	1	2	9	3	8	8	3	3	3	2
8	8	9	1	1	5	1	1	8	9	1	1	1	1	1
-	-	6	6	8	3	-	5	5	6	6	8	6	6	6
9	8	9	-	8	-	5	9	8	9	7	8	9	8	9
7	7	8	10	7	-	10	7	7	8	7	7	7	7	2
-	3	7	7	4	-	6	8	3	7	7	7	7	10	6
3	-	3	3	6	-	-	3	10	3	3	3	3	3	3
8	8	8	2	5	4	-	8	8	8	8	8	8	8	8

C.4 Session 4 - α and β equal 0.75

Nos Picked From Bags							Nos Chosen By Subjects							Winning Option
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	9	9	1	5	9	-	9	9	9	9	5	9	9	9
1	1	1	-	-	6	4	1	1	1	1	1	1	4	1
6	10	-	10	-	10	10	6	6	6	10	6	10	10	10
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
8	8	10	10	1	-	-	8	8	10	10	10	10	10	8
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	10	1	1	10	1	1	10	10	1	1	10	1	1	1
10	10	10	10	7	10	10	10	10	10	10	10	10	10	10
3	6	-	3	3	3	6	3	6	3	3	3	3	3	3

D Results From Each Experiment

	β		
α		0.25	0.75
	0.25	0.125	0.2222
	0.75	0.4	0.9

Table 2: Proportion of Rounds in which the Banerjee Strategy is Played For the Experiment Including Rule A

	β		
α		0.25	0.75
	0.25	0.1	0.2222
	0.75	0.1	0.3

Table 3: Proportion of Rounds in which the Banerjee Strategy is Played For the Experiment Without Rule A

		β							
		0.25				0.75			
α	0.25		Actual	Predicted	Conf. Interval		Actual	Predicted	Conf. Interval
		True Run	0.1	-	-	True Run	0.3	-	-
		True Herd	0	0.2651	-0.0085-0.5387	True Herd	0.2	0.6458	0.3494-0.9422
		False Run	0.2	-	-	False Run	0.3	-	-
		False Herd	0.1	0.6617	0.3685-0.9549	False Herd	0.1	0.2954	0.0126-0.5782
	0.75		Actual	Predicted	Conf. Interval		Actual	Predicted	Conf. Interval
		True Run	0.2	-	-	True Run	0.1	-	-
		True Herd	0.4	0.3923	0.0897-0.6949	True Herd	0.9	0.9023	0.7183-1.086
		False Run	0.3	-	-	False Run	0	-	-
		False Herd	0.1	0.4682	0.1589-0.7775	False Herd	0.1	0.0753	-0.0883-0.2389

Table 4: Actual and Predicted Proportions of True and False Herds For the Experiment Using the Banerjee Rule Plus Actual Proportions of True and False Runs

		β							
		0.25				0.75			
α	0.25		Actual	Predicted	Conf. Interval		Actual	Predicted	Conf. Interval
		True Run	0.3	-	-	True Run	0.3	-	-
		True Herd	0.1	0.1895	-0.0534-0.4324	True Herd	0.5	0.3753	0.0752-0.6754
		False Run	0.1	-	-	False Run	0.7	-	-
		False Herd	0.7	0.8023	0.5554-1.0490	False Herd	0.6	0.6158	0.3143-0.9172
	0.75		Actual	Predicted	Conf. Interval		Actual	Predicted	Conf. Interval
		True Run	0.2	-	-	True Run	0.4	-	-
		True Herd	0.4	0.3744	0.0744-0.6744	True Herd	0.9	0.8399	0.6126-1.0672
		False Run	0.7	-	-	False Run	0.2	-	-
		False Herd	0.4	0.5003	0.1903-0.8102	False Herd	0.1	0.1336	-0.0773-0.3445

Table 5: Actual and Predicted Proportions of True and False Herds For the Experiment Without Rule A Plus Actual Proportions of True and False Runs