University of Pennsylvania
ScholarlyCommons

Social Impact Research Experience (SIRE) | Wharton Undergraduate Research

2011

Risk Aversion in Rural India

Karina Sengupta
University of Pennsylvania

Follow this and additional works at: http://repository.upenn.edu/sire

 Part of the Business Commons

Sengupta, Karina, "Risk Aversion in Rural India" (2011). *Social Impact Research Experience (SIRE)*. 10.
http://repository.upenn.edu/sire/10

This paper is posted at ScholarlyCommons. http://repository.upenn.edu/sire/10
For more information, please contact repository@pobox.upenn.edu.

Risk Aversion in Rural India

Abstract
How does one measure financial risk aversion for a rural individual that has no knowledge of financial products? What household variables influence financial risk aversion? To answer this question, this study implemented Biswanger's Lottery with an added gains and losses competent, in a series of six games, on a sample of 45 individuals drawn from two villages in rural India. For each participant, information on net wealth, net income, occupation and gender was recorded.

The overall distribution of risk class was primarily intermediate risk aversion, followed by severe and moderate risk aversion. While the effect of gender was significant, its relationship with risk aversion was nonlinear. Similarly, the paradoxical behavior of the landless laborer was highlighted and discussed.

Keywords
financial risk aversion, rural India

Disciplines
Business

This working paper is available at ScholarlyCommons: http://repository.upenn.edu/sire/10

Social Impact Research Experience Summer 2011

Risk Aversion in Rural India

Acknowledgements

I would like to thank Professor Katherine Milkman for the Operations and Information Management Department for her guidance; Dr. Martin Asher, Program Director of the Research and Scholars program, for his guidance and support; Bethany Schell and the rest of the SIRE support team; the SIRE program for its kind support.

I would also like to thank Bindu Ananth, Shilpa Sathe and Amit Shah from the IFMR Trust (Chennai, India) for their mentorship and guidance from structuring the study to identifying potential sample villages in Thanjavur; Shreyes Upadhyay, for allowing me to adapt his survey for measuring a rural household's net assets and net income; my translator Jaychandran Earnest; Mani Rajan and family for hosting me at his lovely home in Panaiyur and guiding me around both villages, and the 45 individuals from the villages of Panaiyur and Pawanmangalam that participated in this study.

Table of Contents

Overview

How does one measure financial risk aversion for a rural individual that has no knowledge of financial products? What household variables influence financial risk aversion? To answer this question, this study implemented Biswanger's Lottery with an added gains and losses competent, in a series of six games, on a sample of 45 individuals drawn from two villages in rural India. For each participant, information on net wealth, net income, occupation and gender was recorded.

The overall distribution of risk class was primarily intermediate risk aversion, followed by severe and moderate risk aversion. While the effect of gender was significant, its relationship with risk aversion was nonlinear. Similarly, the paradoxical behavior of the landless laborer was highlighted and discussed.

Literature Review

Theory

The Expected Utility Approach (Arrow Pratt Functions), an "important advance in the economics of uncertainty" determines relationships between risk aversion and wealth. (Menezes and Hanson,1970). Absolute Risk Aversion $\left(A(w) = -\frac{U"(w)}{U'(w)}\right)$ measures risk aversion when wealth is varied, but risk is fixed. Although individuals can have increasing, decreasing or constant absolute risk aversion, Arrow has hypothesized decreasing absolute risk aversion (DARA), i.e.an individual is less risk averse as his or her wealth increases. Relative risk aversion $\left(R(w) = -w * \frac{U"(w)}{U'(w)}\right)$ describes risk aversion when an individual's wealth and the prospect are changed by the same proportion. Arrow formulated that individuals have increasingly relative risk aversion (IRRA), or that individuals are more risk averse when wealth and risky prospects are increased by the same proportion. Partial relative risk aversion determines risk aversion when wealth is fixed, but the risky prospect presented varies, and is denoted as $\left((w,m) = -m * \frac{U"(w)}{U'(w)}\right)$ where m is defined as the size of the payoffs. Arrow formulates increasing partial risk aversion, or that individuals are more risk averse as the scale of the prospect increases when wealth is kept constant.

While Expected Utility assumes that Risk Aversion is primarily a function of an individual's wealth, Prospect Theory, developed by Tversky and Kahneman (1979), asserts that an individual's risk appetite is determined by how a prospect is presented. An implication of Propect Theory is *Loss Aversion,* or that an individual is risk seeking for gains, and risk averse for losses. This is contrary to the Expected Utility framework that assumes individuals will react similarly to prospects that provide the same expected outcome, regardless of whether it is

expressed as a gain or loss. Kahenmen and Tversky termed this effect as the reflection effect, and showed that preferences can be mirrored depending on whether they are presented in terms of purely gains, or as a gain or loss.

Kahenmen and Tversky (1979) reject asset integration, which postulates that an individual's risk aversion is a function of his or her final wealth. Prospect Theory postulates the isolation effect, which states that individuals evaluate risky prospects without evaluating the impact on final wealth levels. Thus, while the Expected Utility theorem states that total overall wealth, or the *final state* of wealth, determines risk aversion, the isolation effect states that *changes in wealth* are more important to determine risk aversion. This implies that proxies for final wealth level, such as net assets or net income, may not be predictors for risk aversion. Biswanger (1980) and Rabin (2000) reject asset integration as well.

Measurements of Risk Aversion

The first non-interviewer attempt to measure risk aversion in a developing world context was Hans Biswanger's lottery approach (1980), implemented in rural India (and henceforth referred to as the Biswanger Lottery.) The lottery is as follows: Respondents were given a set of games, marked from O to F, as show below in Table 1. Each game had two payoffs: Tails represented a higher payoff, while the amount under heads represents a lower payoff. Farmers had to choose a game from O to F, and a coin was flipped to determine the outcome and a real payoff was made accordingly.

Table 1: Biswanger's Lottery

Game Number	Heads	Tails
O	50	50
A	45	95
B	40	120
D*	35	125
C	30	150
D	20	160
E	10	190
F	0	200

Table 2: Elaboration of Biswanger's Lottery

Game	Heads	Tails	Expected Outcome	Standard Deviation	Z=△E/△SD	Risk class	Approximate Partial Risk Aversion Coefficient
O	50	50	50	0	1to 0.80	Extreme	∞ to 7.51
A	45	95	70	35	.8 to .66	Severe	7.51to 1.74
B	40	120	80	57	.66 to .5	Intermediate	1.74 to 0.81
D*	35	125	80	64		Inefficient	
C	30	150	90	85	.5 to .33	Moderate	0.81 to 0.32
D	20	160	90	99		Inefficient	
E	10	190	100	127	.33 to 0	Slight to Neutral	0.32 to 0
F	0	200	100	141	0 to -	Negative to Neutral	0 to -∞

For each successive game (from O to F) as the expected value increased, so did the standard deviation. *Table 2*, shown above, illustrates the relationship between the expected

outcome, standard deviation and the partial risk aversion coefficient, which in turn determined the risk class of an individual.

The six risk classes Biswanger adopted (in descending order of risk aversion) were: Extreme, Severe, Intermediate, Moderate, Slight to Neutral, and Neutral to Risk Seeking. As seen above, choices D and D* represented inefficient options, i.e., options which had the same expected outcome as B and C respectively, but a larger standard deviation. For the purposes of classification, individuals that selected option D and D* were grouped into into the risk classes of option B and C respectively (ie, intermediate and moderate respectively).

The Rs. 50 game was replicated at the following scales: 1/100, 1/10 and 10 (equivalent of Rs. 0.50, Rs. 5 and Rs. 500 game levels). This tested for increasing partial risk aversion, or whether increasing or decreasing the scale of payoffs would alter an individual's risk class. Furthermore, the lottery made both real payoffs as well as presented hypothetical situations. Although participants were more risk averse in real payoffs, this difference was not statistically significant.

Overall, the sample had a moderate risk aversion. Assets, measured as gross sale value of physical assets, had a negative relation with risk aversion, which was significant at the Rs. 0.5 and Rs. 5 level, but not at the Rs. 50 and Rs. 500 level. Its impact on risk aversion is not massive- at a Rs. 5 level, the shift of wealth from the average level to the largest level would imply a shift from moderate risk aversion to risk neutrality. However, at the Rs. 50 level and Rs. 500 level, or games that involved amounts that are "commensurate with monthly wage levels or small agricultural investments", wealth has "little impact" on risk aversion. The author suggested the use of net worth of assets as a better measure of wealth.

Women were more risk averse than men, although this was not statistically significant. Biswanger believed there was little evidence to support the hypothesis that women were less risk averse than men, however, he said this may have been confounded since none of the women in the sample had ever attended school. Age was positively correlated with Risk Aversion for the Rs. 0.5 and Rs. 5 level, but negatively correlated at the Rs. 50 and Rs. 500 level

Bruntup (2000) implemented the Biswanger lottery in 75 households in Benin. In this study, a farmer was given gift money and the choice to stay on and play in the lottery, or leave. The lottery was played thrice: first, at a 50 FCFA level with real payoffs, at the 500 FCFA level with real payoffs, and lastly hypothetical game at the 5000 FCFA level. Farmers gambled separately to ensure that they were not influenced through the "luck" factor. Bruntup noted that payoffs were structured to be comparable with real income decisions – for example 500 FCFA is indicative of several days of cash income for a farmer. Although Bruntup observed an overall level of severe risk aversion, he noted that in "real economic decisions with a higher time horizon" such as decisions to make expensive agricultural investments such as mineral fertilizers or farming equipment, expected risk aversion would be higher.

Yesuf and Bluffstone (2007) ran the lottery on a sample of 262 individuals chosen randomly from 12 villages from rural Ethiopia. The lottery was framed in the following manner: farmers were told that to assume six different farming systems, each costing the same, but the outcomes would vary depending on whether there is a good harvest or a bad harvest. THouseholds had one of the following six outcomes: A coin was flipped to reveal whether there was a good harvest or a bad harvest, and real payoffs were made according. This experiment was split into two sections. The first part was designed as a "gains only" game., and was played consecutively in 5 different scales in '5 sets' – initially at at Birr 0.5 level, and scaled up to Birr

2.5, Birr 5, Birr 10, and Birr 15. The second part of the game comprised of the same games expressed in terms of gains and losses. Only farmers that made enough in the first part could participate in the second portion. Set 5 of the game (at Birr 15) was played at a hypothetical level to ensure that there were no major losses. An example of the payoff structure at the 0.5 level is shown below

Table 3: Gains only and Gains and Losses game at 0.5 Level.

Game	First Part: Gains Only		Risk class	Second Part: Gains and Losses	
	Bad Harvest	Good Harvest		Bad Harvest	Good Harvest
1	0.5	0.5	Extreme	0	0
2	0.45	0.95	Severe	-0.05	0.45
3	0.4	1.2	Intermediate	-0.1	0.7
4	0.3	1.5	Moderate	-0.2	1
5	0.2	1.6	Slight to Neutral	-0.3	1.1
6	0.1	1.9	Negative to Neutral	-0.4	1.4

The results are as follows: 50% of the farmers were classified under extreme to severe risk aversion categories. Farmers treated gains only and mixed games (gains and losses) differently; reproducing the same game in a mixed game form had a 'statistically significant and empirically large effect,' thus producing behavior that was more risk averse, reaffirming the prospect theory. Increasing partial risk aversion, or a trend of increasing risk as the scale of the prospect was increased with constant wealth, was observed. Decreasing absolute risk aversion was observed, which implied that that wealthy households were more willing to make risky investments for higher returns.

Holt and Laury (2002) formulated a switch lottery, in which students were presented with a choice such as 1/10 of $2, 9/10 of $1.6 or 1/10 of $3.85, 9/10 of $0.10, and were successively

presented with ascending choices (2/10 of $2, 8/10 of $1.6 or 2/10 of $3.85, 8/10 of $0.10). The point at which an individual switched over from A to B is used to measure an individual's risk aversion. This approach was not adapted due to the complexity of probabilities involved – the sample for Holt and Laury's study were business students who had a knowledge of statistics, while the sample for this study are farmers who may not have a nuanced understanding of probability.

Hartog et al (2000), implements a direct approach, where individuals are asked to name the price he or she is willing to pay for a lottery ticket. This approach would not be feasible in developing countries for the several reasons- firstly, it would require an understanding of a lottery. Secondly, in regions where gambling is banned, this approach would be unfeasible. Thirdly, it is subject to an interviewer's bias.

Methodology

A series of 6 games was constructed, which was modeled off Biswanger's lottery with an additional gains and losses component. The experiment was split into two phases – Game 1 to game 4 was administered on Day 1, and Game 5 and Game 6 was administered after a minimum gap of 4 days. The games and the underlying description are as follows:

Game 1		
O	50	50
A	45	95
B	40	120
C	30	150
D	20	160
E	10	190
F	0	200

Game 2		
O	100	100
A	90	190
B	80	240
C	60	300
D	40	320
E	20	380
F	0	400

*Imagine that you had to **place Rs. 50** (Rs. 100 for Game 2) in one of the following 7 options. If it is a good day (50% chance) you will receive the amount in the right column. If it is a bad day, (50% chance) you will receive the amount in the left column. Which game will you choose?*

Game 3 and Game 4 are the same as Game 1 and 2, but expressed in a gains and losses form. The payoff and accompanying instructions are as follows:

Game 3		
O	0	0
A	-5	45
B	-10	70
C	-20	100
D	-30	110
E	-40	140
F	-50	150

Game 4		
O	0	0
A	-10	90
B	-20	140
C	-40	200
D	-60	220
E	-80	280
F	-100	300

Imagine that you had to make a choice from the following 7 options. If it's a good day (50%

chance) you will receive the amount in the right column. If it's a bad day (50% chance), you will received the amount in the left column. Which game will you choose?

After a gap of minimum 4 days, Game 5 & Game 6 was administered. The payoffs, which are given below, are the same as game 1 & game 2. The addition of these two games would be tested to see whether preferences were stable over time, i.e., measure that the choices are consistent.

Game 5		
O	50	50
A	45	95
B	40	120
C	30	150
D	20	160
E	10	190
F	0	200

Game 6		
O	100	100
A	90	190
B	80	240
C	60	300
D	40	320
E	20	380
F	0	400

While playing the game, no effort will be made to isolate participants from their peers – such as family and close friends. This was done to mimic the setting in which real financial decisions are made in a rural setting – i.e., in a communal manner. Furthermore, the payoff structures will be left with the participants for the duration of the entire experiment to allow for long periods of consultation.

No real payoffs are made – only hypothetical scenarios are presented. This is because the sample villages were in the state of Tamil Nadu in India, which has laws banning gambling- thus handing out real payoffs would be illegal. To mimic a real financial decision, the experiment was preceded by a rigorous questionnaire (attached in the appendix) that surveyed every household for accurate information on its assets, liabilities, income and liabilities. Although the collected household data was used for determining relationships with risk aversion, it was a primer for individuals to provide accurate information when answering each game.

Rs. 50 and Rs. 100 were chosen as the two scale points after looking at both the daily wage of an agricultural laborer (which was Rs. 80 to Rs. 130), as well as as the current array of micro insurance and micro investment products (money market mutual funds, gold coins).[1] As this study aimed to understand risk aversion as applicable to personal finance decisions, such as the risk appetite for a micro insurance or micro investment products, larger amounts were not considered. Extending the study to include larger amounts would reflect risk appetite for larger investment decisions, such as setting up a small business, or purchasing agricultural machinery. However, it would not reflect their response to current micro insurance and micro-investment products offered in the region.

Table 4: Extension of Game 1 with risk classes and partial risk aversion coefficient

Game	Heads	Tails	Expected Outcome	Standard Deviation	Z=∆E/∆SD	Risk class	Approximate Partial Risk Aversion Coefficient
O	50	50	50	0	1to 0.80	Extreme	∞ to 7.51
A	45	95	70	35	.8 to .66	Severe	7.51to 1.74
B	40	120	80	57	.66 to .5	Intermediate	1.74 to 0.81
C	30	150	90	85	.5 to .33	Moderate	0.81 to 0.32
D	20	160	90	99		Inefficient	
E	10	190	100	127	.33 to 0	Slight to Neutral	0.32 to 0
F	0	200	100	141	0 to -	Negative to Neutral	0 to -∞

Table 4 elaborates the game at the Rs. 50 level, aswell as corresponding risk classes. Game D is an inefficient factor in our game- it had the same expected return as Game C (which was a moderate risk class), but a larger standard deviation. For the purpose of analysis, the results of Game D will be grouped with Game C, under moderate risk aversion, as done in Biswanger (1980), Bruntup (2000) and Yesuf and Bluffstone (2006).

[1] Refer to IFMR Rural Channals for an elaboration of products: http://ruralchannels.ifmr.co.in/the-kgfs-way/products-array/product-chart/

Restricting the game at the Rs. 50 and Rs. 100 limits testing the scale effect to a maximum of 2x. The results of testing for scale cannot be extended to understanding an individual's behavior at higher levels.

Sample Statistics

A total of 45 individuals from 28 households were interviewed from 2 villages (37 individuals from Panaiyur and 11 from Pawanamangalam), in the district of Thanjavur, Tamil Nadu. India. From the 45 individuals interviewed, 17 (38%) were female.

Occupation was reported as primary occupation of the household, as well as primary occupation of the individual. 64% of households reported their primarily occupation as agriculture (out of which, one third were landless), while 18% reported it as own business owners and another 18% as salaried workers. From an individual perspective, 39% reported his or her primary occupation as agriculture (landless comprising 11%), 29% as housewives, 17% owned a business, while 15% were salaried.

Net Income was measured as total reported income minus total reported expenses. The average income Rs 105,570, with the median at Rs. 26,325 denoting the presence of outliers – the minimum net income was – 11,900, while the maximum net income was Rs. 884,000.

Net Assets was calculated as Current Assets + Non-Current Assets – Liabilities. The survey used is attached in the appendix. The definitions of each are elaborated below

- Current Assets include Cash holdings, Savings in deposit account, Bullion and ornaments, Accounts receivable, Livestock, Inventory (Raw Material, Work in Progress, Finished Goods)
- Non-Current Assets include Household, Agricultural assets, business assets as well as Land/other fixed asset
- Liabilities are self-reported amounts owed to money lenders, institutions or other individuals

The average reported net wealth was Rs. 1.89 million, and the median was Rs. 640,000. There was great variance in the distribution with two peaks on the extremes, and a bell shaped distribution from Rs 200,000 and Rs. 1.2 million. While the largest proportion of households (35%) reported net asset between Rs. 0 -200,000 , 25% of households reported net assets greater than Rs. 1.6 million, while none reported net assets between Rs 1.2 million and 1.6 million.

Results

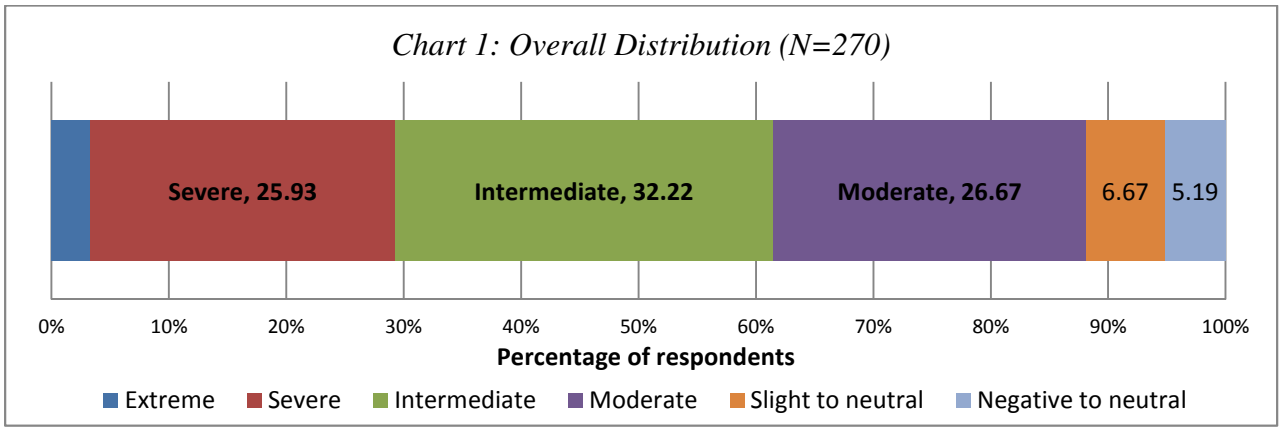


Table 5: Results of the 6 games

Risk Class	Game Choice	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6
Extreme	O	2	2	0	1	1	3
Severe	A	14	13	10	9	12	12
Intermediate	B	16	15	14	16	11	15
Moderate	C	7	7	11	7	10	8
Inefficient	D	1	4	3	7	4	3
Slight to neutral	E	3	3	4	1	4	3
Negative to neutral	F	2	1	3	4	3	1

The results of the experiment are summarized in table 5 above. The 6 games are summarized in chart 1. Overall, the sample had intermediate risk aversion, with more than half the sample split between severe and moderate risk aversion (25.93% and 26.67% of the sample respectively).

The chi square was not significant for the Game 1&5 (Rs. 50 games which were not expressed in terms of gains and losses) as well as Game 2 & Game 6 (Rs. 100 games which were not expressed in terms of gains and losses). This implies that the preferences captured by gains only games at the Rs. 50 and Rs. 100 level was stable.

However, the low cell counts in the some of the cells, where 6 cells had less than 5 counts, could pose a limitation to the accuracy of this test.

Testing the Scale Effect

Table 6: Testing the scale effect for Rs. 50 and Rs. 100

Risk Class	Count (N= 270)		In Percentage	
	Rs. 50	Rs. 100	Rs. 50	Rs. 100
Extreme	3	6	2.22	4.44
Severe	36	34	26.67	25.19
Intermediate	41	46	30.37	34.07
Moderate	28	22	20.74	16.30
Inefficient	8	14	5.93	10.37
Slight to neutral	11	7	8.15	5.19
Negative to neutral	8	6	5.93	4.44

The scale effect, or increasing partial risk aversion implies that a higher payoff, given the same wealth, would result in a choice that is more risk averse. Games played at a Rs. 50 level (Game 1, Game 3, and Game 5) were tested against the Rs. 100 games (Game 2, Game 4 and Game 6). The Chi square test failed to reject the Null hypothesis, which stated that there was no significant difference between the responses at the Rs. 50 and Rs. 100. This does not reject increasing partial risk aversion in its entirety, as the increase in scale may not be significant enough to cause a change in risk aversion.

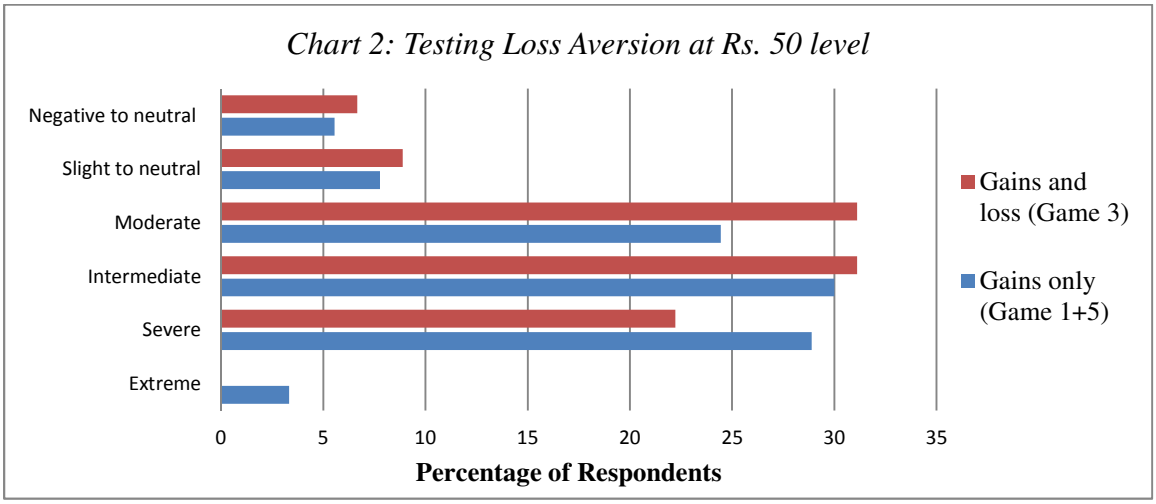
The Scale effect was tested separately for games expressed in gains only, and gains and losses. It was not significant for gains only games (Game 1 and Game 5 at the Rs. 50 level, and Game 2 and Game 6 at the Rs. 100 level). It was not significant for gains and losses games (Game 3 at the Rs. 50 level, and Game 4 at the Rs. 100 level) at 0.05 level, but was significant at 0.10 level. In both two tests, there were multiple cells which had a count less than 5 – and this was a limitation in interpreting the effectiveness of the chi-square test.

Loss Aversion

To test loss aversion, the chi-square is tested on games expressed in gains and losses to games that are expressed as gains only – thus

For the Rs. 50 game, loss aversion was significant at the 0.05 level. However, this statistic is not reliable as cell counts were less than 5 in 4 occasions. Chart 2, shows a shift towards more risk seeking classes in the gains and losses game as compared to the gains only game. However, one cannot determine whether this is statistically significant or not.

Chart 2: Testing Loss Aversion at Rs. 50 level



At the Rs. 100 game, loss aversion was significant at the 0.05 level. However, this statistic is not reliable as cell counts were less than 5 in 5 occasions.

Relationship with Household Variables

The household variables observed are net assets, net income, occupation, and gender. The distribution of risk aversion by gender is significant, and is discussed below. Due to the number of categories as well as sample size, a regression or a chi-square was not implemented to determine the significance of net asset, net income and occupation.

To examine the relationship with net assets and net income and occupation, graphical representations of the *distribution* of a household variable for a particular risk class are shown for each of these three variables. An analysis of the key trends from these graphs is thus presented in this section.

Net Assets

Chart 3: Risk Aversion and Net Wealth (in Rs. hundred thousand)

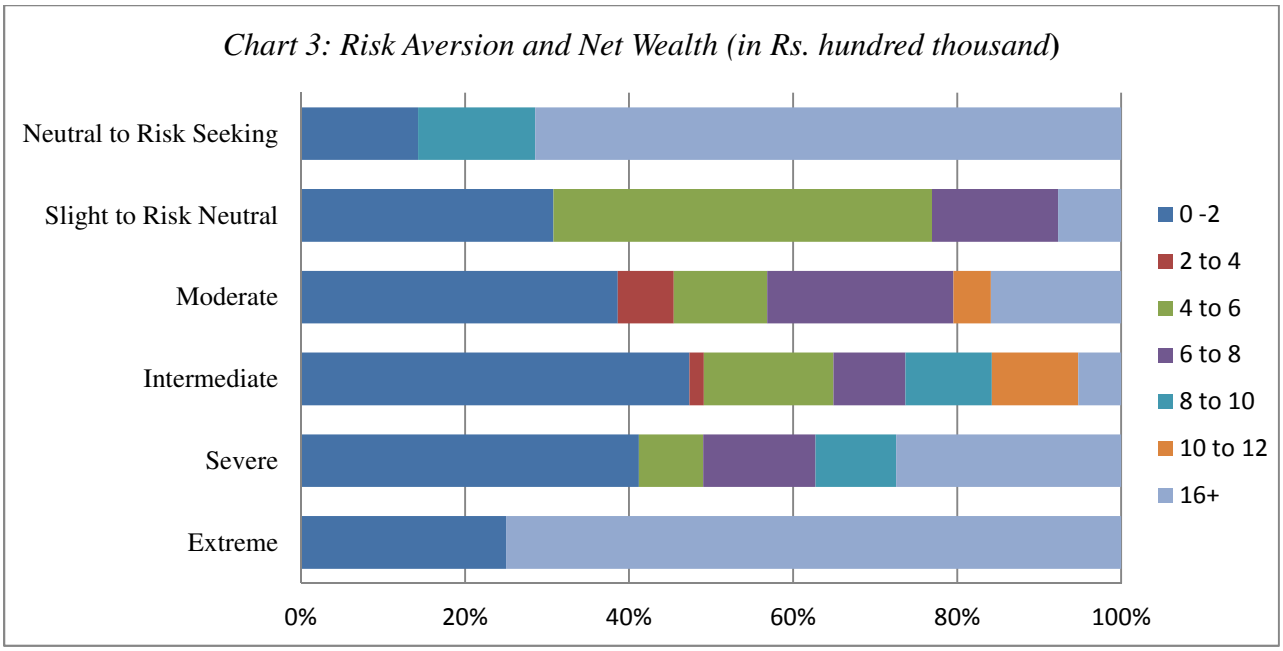


Chart 3, the distribution of extreme and risk seeking classes displays an interesting trend. More than 70% of those who displayed extreme and risk seeking behavior were those with the highest category of net wealth- i.e., with a net wealth of RS. 1.6 million or greater. Under the extreme risk classification, the only other wealth group that was represented was that with a net

wealth below Rs. 200,000. This suggests the behavior of individuals with the most and least assets in the sample display risk seeking as well as extreme risk averse choices – unlike any other income class in the sample.

Net Income

Chart 4: Risk Aversion and Net Income (in RS. thousand)

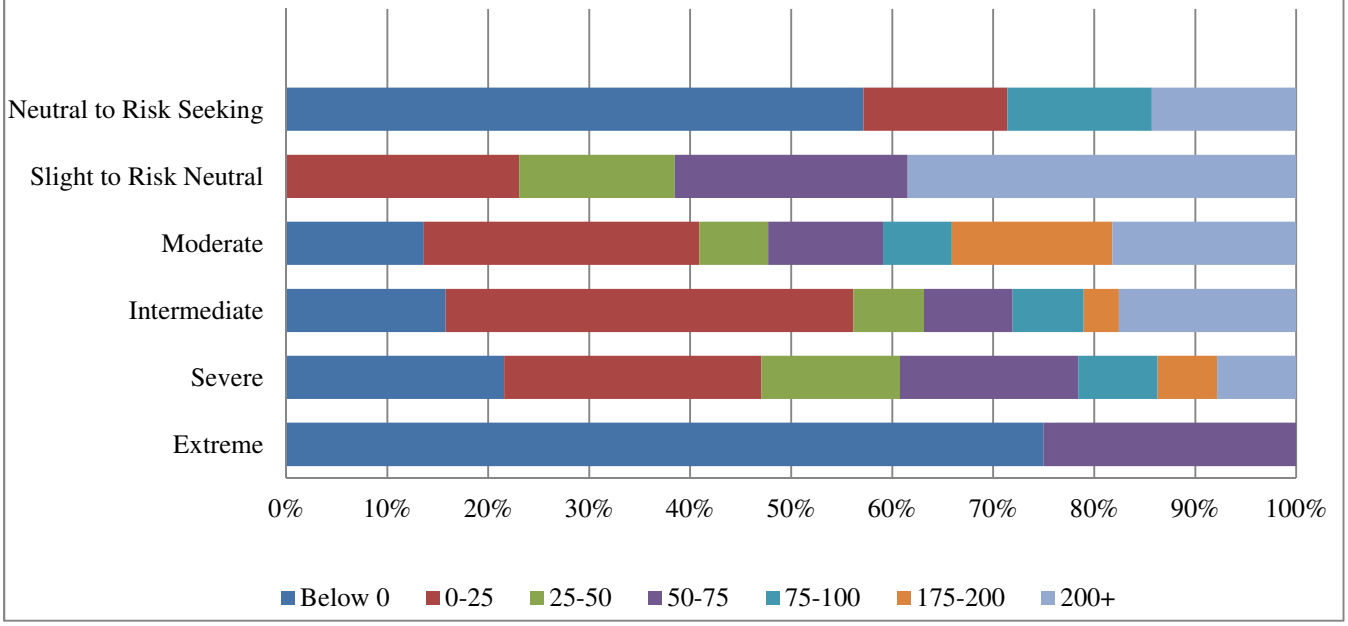


Chart 4 illustrates the composition of each risk aversion class by net income level. 75% of the respondents in the extreme risk class, and 57.14% in the risk seeking class were those with a negative net income. Like the previous graph, this once again suggests that the lowest income household tends to display two extremes of risk appetite– both risk friendly, and extreme risk aversion.

Occupation

Occupation was categorized into own business owners, salaried workers, agriculture is further subdivided into landless laborers, agriculture workers who owned less than 1 acre of land, agricultural workers who owned 1-5 acres of land, and agricultural workers who owned greater than 5 acres of land.

Chart 5: Risk Aversion and Occupation

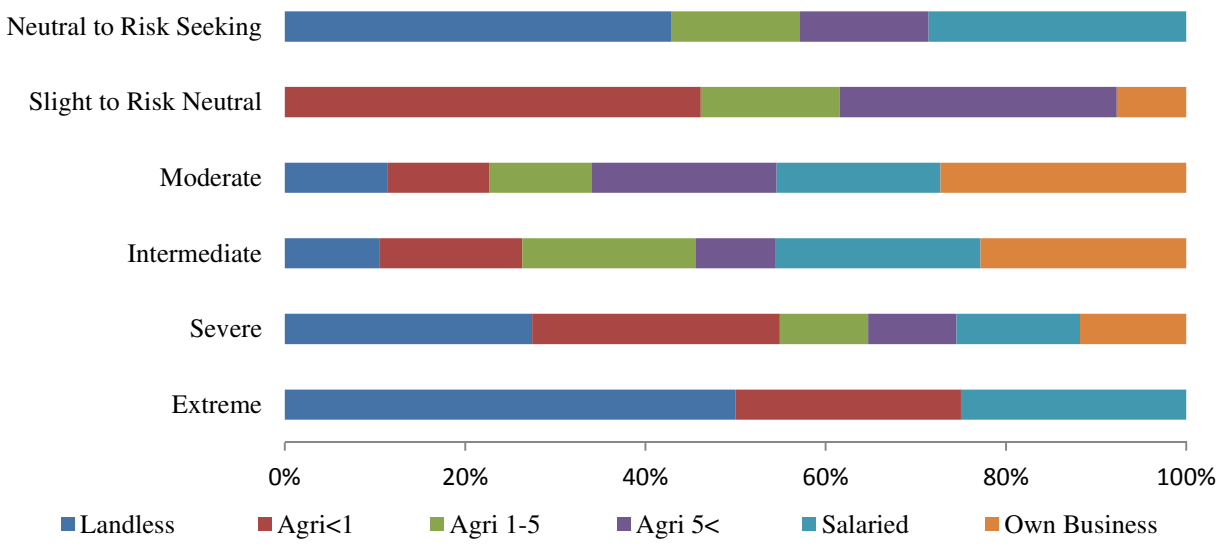
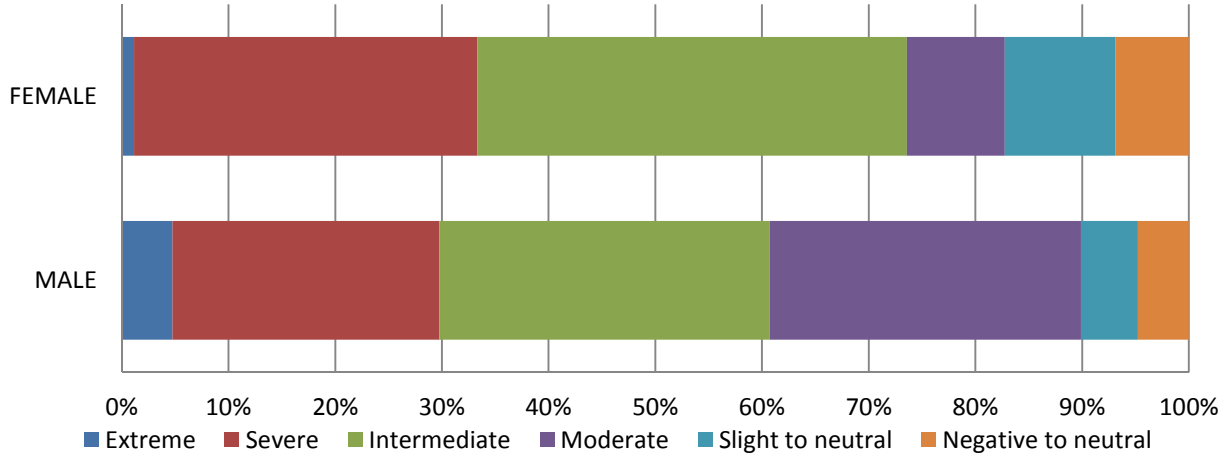


Chart 5 summarizes the composition of each risk class by agriculture. The landless laborer, the occupation that usually has a negative net income and the lowest value of net assets, displays a similar "behavior of the extremes" seen in net assets and net income - 42.8% of the risk seeking class, and 50% of the extreme risk aversion class is comprised of landless laborers. Salaried workers are the only other occupation that is represented in both extreme risk aversion class as well as risk seeking class. Own business, or individuals that own and run a business, is the only occupation that does not display either extreme risk aversion or risk seeking behavior.

Gender

A chi square test that tested that the difference in the distribution of risk aversion for males and females was statistically significant.

Chart 6: Risk Aversion and Gender



A larger proportion of women are have a severe risk aversion or higher (73.56% for women, 60.71% for men). Only 9.2% of the women in the sample displayed moderate risk aversion, as compared to 29.17% of the men in the sample. However, a larger proportion of women show slight to neutral (10.34% and 5.36% for men) and neutral to risk seeking behavior (6.9% for women, 4.76% for men). This suggests that the relationship between risk aversion and gender may not be linear as suggested by previous studies.

Conclusion

Overall, this study observes mostly intermediate risk aversion across all 6 games, followed by both severe and moderate risk aversion. It notes a nonlinear relationship between risk aversion and household characteristics.

The landless laborer, an individual in our sample that has a sample had a negative net income and low net assets, comprises the majority of respondents in the extreme risk aversion and risk seeking classes. This contradictory behavior indicates that the relationship between wealth and risk aversion may not be linear. Furthermore, since the landless laborer forms a majority of India's poor, and this paradoxical relationship is perhaps one way to differentiate this occupation from other occupations.

According to Biswanger (1980), there was no statistically significant difference between risk class observed in hypothetical and real payoffs are made. This study was primed with a survey on financial assets and liabilities, and thus the answers were made with an emphasis on accuracy. Although real payoffs can show how a farmer makes a decision when faced with real money, it may not accurately reflect a rural household's financial decision, but rather mimic gambling.

An improvement moving forward would be to increase the sample size for the experiment. The sample size (N=45) limited the interpretation of the chi-square (as cell counts were often less than 5).

Finally, since this study was motivated to understand the role of risk aversion in personal finance decisions, more research should be done in the utility of understanding risk aversion for a rural household in this context. One way would be to further investigate barriers a household faces in adapting to micro-insurance and micro-investment products, such as financial literacy as noted in Cole et al. (2009) may play a role in impacting risk aversion.

Works Cited

Binswanger**,** Hans P. Attitudes toward Risk: Experimental Measurement in Rural India, *American Journal of Agricultural Economics*, Vol. 62, No. 3. (Aug., 1980), pp. 395-407.

Brüntrup, Micheal. "The level of risk aversion among African farmers –results of a gambling approach." Presented at Deutscher Tropentag 2000

Cole Shawn, Xavier Giné, Jeremy Tobacman, Petia Topalova, Robert Townsend, James Vickery. "Barriers to Household Risk Management- Evidence from India". *The World Bank*, Development Research Group, Finance and Private Sector Development Team, December 2010

Hartog ,Joop, Ada Ferrer-i-Carbonell & Nicole Jonker, **"**On a Simple Measure of Individual Risk Aversion" *Tinbergen Institute Discussion Paper 2000.*

Holt Charles A. and Susan K. Laury (2002): Risk Aversion and Incentive Effects, *American Economic Review*, 92(5): 1644-1655.

Kahneman Daniel & Amos Tversky. Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty*, 5:297-323 (1992)

Menezes C. F. and D. L. Hanson, On the Theory of Risk Aversion, *International Economic Review*, Vol. 11, No. 3 (Oct., 1970), pp. 481-487

Rabin, Matthew & Thaler, Richard. H. 2001. ‘Anomalies: Risk aversion', *Journal of Economic Perspectives* 15(1), 219 - 232.

Yesuf Mahmud and Randy Bluffstone, “Risk Aversion in Low Income Countries: Experimental Evidence from Ethiopia*“ IFPRI Discussion Paper 00715*

Appendix: I) Household Survey

(1) Household composition:

1.	Household Size	
2.	Household Type (*Kaccha-1/Pukka-2/Semi-pukka-3*)	
3.	Weather any household member has and Kisan credit card. (*Yes-1, No-2*)	
4.	If yes in question 4, then the amount received during the last 365 days.	

(2) Particulars of the households:

S.no.	**Name of member**	**Relation to head**	**Sex (M-1, F-2)**	**Age (years)**	**Marital status**
1.					
2.					
3.					
4.					

S.no	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Name(From previous table)								
Educational qualification								
Approximate Level of education								
Does he/she receive money								
Salaried/Daily wages								
How much (`)								
Primary occupation								

Any seasonality, Please specify								
If working in farm, average hours spent on field in a week								
Seasonality(number of months he/she works on the farm)								
Life insurance(Y/N) If yes coverage amount(`)								
If yes, premium amount(`)								
Accident insurance(Y/N) If yes coverage amount(`)								
If yes premium amount(`)								
Is he/she away from family(Y/N)								
Does he/she send money(Y/N)								
How much (`)								

Expenses:

Household Expenses (`)	**Frequency (daily/monthly/yearly)**	**Amount per frequency (`)**
Ration	Monthly	
Festivals		
(i) Diwali	Yearly	
(ii) Eid	Yearly	
(iii) Pongal	Yearly	
(iv) Other festivals	Yearly	
Home maintenance	Yearly	
Electricity bill	Monthly	

Telephone/mobile bills	Monthly	
Cattle/livestock food	Monthly	
Health expenses	Monthly	
School fees	Monthly	
Miscellaneous	Monthly	

Other expenses incurred by the household: (Over the last one year)

Item description	Quantity/number of times	Value (`)
A. Residential plot and building		
Purchase of plot		
Lease amount, if land taken on rent		
Improvement of plots		
Purchases of house , building or any other residential construction		
Any major repair of building or other construction owned		
B. Farm Business		
Purchase of land		
Lease amount, if land on rent		
Purchase of farm houses, barns & animal sheds		
Purchase of agricultural machinery and implements		
Fertilizers/Seeds		
Purchase of any transport equipment		
Livestock purchase		
Any major repairs of agricultural equipment		
Any major repairs of transport equipment		
Storage cost for the finished crop		

Any other expenditure on farm business, if yes specify,		

Item description	Amount/quantity/number of times	Value (`)
Non-farm business		
Purchase of land		
Lease amount, if land taken on rent		
Improvement/maintenance of land		
Purchase of shop/work place		
Construction of workshop/shop		
Material kept in stock(inventory)		
Maintenance charges (electricity bill, telephone bill, salary of workers)		
Any other expenditure on non-farm business, please specify		

Income/Revenue generated from farm business: (Over the last one year)

Item description	Quantity	Value (`)
Sale of plot/land		
Sale of farm house barn shed, any other building		
Crop harvested (In bags)		
Revenue generated from selling the produce		

Income/Revenue generated from nonfarm business: (Over the last one year)

Item description	Quantity	Value (`)
Sale of plot/land/workplace/shop		

Lease amount, if land has been given on lease		
Revenue generated from sales		
Revenue generated from any other activities, specify		

Assets:

(3) Land owned by household:

S.no.	**Type of land owned**[2]	**Area owned (Acres)**	**Value as on date of survey** (`)

Have you given your land on lease(Y/N)			
Area			
Amount			
Harvest share			

[2] *Type of land owned:*
Seasonal crop area irrigated - 1,
Seasonal crop area unirrigated – 2,
Orchards and plantations(including forest) – 3,
Area put to non- agricultural uses : water bodies – 4,
Exclusively for non-farm business – 5,
Other non-agricultural uses –6 ;
Residential area including housesite-7
Other areas – 9.

(4) Buildings and other constructions owned by household:

S.no	Item	Owned as on date of survey	
		Area owned	**Value (`)**
1.	Residential building		
2.	Barn		
3.	Animal shed		
4.	Farm house		
5.	Others		
6.	Workshop/workplace		
7.	Shop		
8.	Incomplete structures (work-in-progress)		
9.	Total(1-8)		

Have you rented any part of your house(Y/N)	
If yes, Monthly rent (`)	

Advance received (`)	

(5) Livestock and poultry owned by household:

S.no.	Item		Owned as on date of survey		
			No.	Age	Value(`)
1.	**Cattle**	**(a) Female:** i. Breeding cow: in milk			
2.		ii. Breeding cow: dry			
3.		iii. Not calved even once			
4.		iv. Calve			
5.		**(b) Male:** i. For work/breeding			
6.		ii. Calve			
7.	**Buffalo**	**(c) Female:** v. Breeding cow: in milk			
8.		vi. Breeding cow: dry			
9.		vii. Not calved even once			
10.		viii. Others			
11.		**(d) Male:** iii. For work/breeding			
12.		iv. Others			
13.	**Other large heads**	Horse, mule & pony			
14.		Donkey			
15.	**Ovines, pigs, rabbits.**	Sheep			
16.		Goat			
17.		Pig			
18.		Rabbit			
19.	**Poultry birds.**	Cock			

20.		Hen			
21.		Chiken			
22.		Other poultry birds			
23.	Others				
24.	Total(1-23)				

(6) Agricultural machinery owned by household:

S.no.	Item	Owned as on the date of survey	
		Number	Value (`)
1.	Sickle, axe, spade & chopper		
2.	Plough (wooden / iron)		
3.	Seed-drill, sprayer		
4.	Tractor (excluding trolly)		
5.	Thresher		
6.	Canecrusher- power operated		
7.	Canecrusher- others		
8.	Oil crusher-power operated		
9.	Oil crusher- others		
10.	Pump-electric		
11.	Pump- others		

12.	Other water lifting equipment (viz. persian wheel, dhenki, etc.)		
13.	Furniture and fixtures		
14.	Others		

(7) Transport equipment owned by household:

S.no	Item	Owned as on the date of survey		
		Number	How old	Value (`)
1.	Carts (hand-driven / animal driven)			
2.	Bicycles			
3.	Rickshaws			
4.	Motor cycles/ scooters/ mopeds/ autorickshaws			
5.	Motor cars/jeep/van			
6.	Trucks/light comm. vehicles (LCV)/passenger buses			
7.	Tractor-trollies/ trailers/jugads			
8.	Boats			
9.	Other transport equipment			
10.	Total(1-9)			

(8) Durable assets owned by household:

S.no	Item	Owned as on the date of survey		
		Number	How old	Value (`)
1.	Bedstead			
2.	Steel / wooden almirah / dressing table			
3.	Other furniture & fixtures			
4.	Radio, record player/tape recorder/stereo			
5.	Television			
6.	Other goods for recreation , entertainment (eg. VCR/VCP/VCD, DVD Player, PC)			
7.	Gas/electric oven/cooking range/ microwave oven			
8.	Electric fan, clock/ watch, water filter / electric iron/ sewing machine			
9.	Refrigerator/ air cooler/ air conditioner/ washing machine			
10.	Other cooking and household appliances			
11.	Bullions & ornaments			
12.	Other durables			
13.	Total(1-14)			

(9) Financial assets owned by households in cooperative societies and companies:

S.no.	Type of institution	Value as on the date of survey (`)	Rate of interest (%)
1.	Cooperative credit society/bank		
2.	Government certificates viz. NSC , Indira vikas patra, kisan vikas patra, RBI Bonds etc.		
3.	Deposit in post office including national saving scheme deposits		
4.	Commercial bank		
5.	Deposit with individuals		
6.	Cash in hand		
7.	Unsecure loan		
8.	Professional dues, trade credit		
9.	Kind loans		
10.	Others		
11.	Total(1-7)		

Liabilities:

Kind of loans and liabilities payable by the household:

S.no.	Nature of liabilities (cash-1, kind-2)	Period	Source[3]	Purpose[4]	Rate of interest charged	Amount outstanding as on the date of survey (`)

[3] ***source :***
trader –1, relatives & friends -2, doctor, lawyers and other professionals–3,financial institution-4, others -9

[4] ***purpose :***
c*urrent expenditure in farm business - 1, current expenditure in non farm business -2, other household expenditure - 3, other*
expenditure -9

Detail of use the loan has been put to:

Sno. (from above)	**Where has the loan been invested**	**Return on investment**

Any amount pending to the suppliers:

Any amount payable to the supplier(Y/N)	
If yes how much	
When is the amount pending	

Appendix: II) Game Results

Game	1	2	3	4	5	6
PNY_01	A	A	B	C	E	A
PNY_02	D	D	C	C	F	C
PNY_03	F	O	F	O	F	O
PNY_04	A	A	A	A	A	F
PNY_05	C	D	D	A	E	E
PNY_06	A	B	C	B	A	B
PNY_07	C	A	E	F	D	B
PNY_08	A	A	C	C	A	A
PNY_09	C	C	D	D	B	C
PNY_10	B	C	E	C	C	D
PNY_11	A	A	B	D	C	C
PNY_12	B	B	C	B	B	B
PNY_13	A	A	B	A	A	A
PNY_14	B	A	B	B	B	B
PNY_15	A	B	D	C	B	B
PNY_16	B	A	B	D	C	A
PNY_17	B	C	B	B	C	C
PNY_18	E	E	A	A	F	C
PNY_19	B	B	B	B	C	B
PNY_20	O	A	C	B	O	O
PNY_21	C	B	B	F	B	C
PNY_22	B	C	C	B	C	D
WIFE _3	B	A	B	B	A	B
WIFE _4	A	B	B	D	A	B
WIFE_5	E	E	A	A	A	A
WIFE_6	E	C	A	F	B	E
MOTHER_7	A	C	C	B	A	D
WIFE_11	A	A	F	C	C	B
WIFE_14	A	B	E	E	E	B
WIFE_15	A	B	A	A	A	B
MOTHER_18	C	C	F	F	C	B
WIFE_19	B	B	C	A	D	B
MOTHER_21	C	B	A	D	B	A
MOTHER_22	C	B	B	C	C	C
PWN_1	A	A	B	B	B	B
PWN_2	B	B	C	D	E	E
PWN_3	B	D	A	D	B	A
PWN_4	O	O	C	B	A	A

PWN_5	B	B	C	B	B	B
PWN_6	A	A	A	A	A	A
PWN WIFE_1	B	B	B	A	A	A
PWN WIFE_3	B	E	A	B	D	A
PWN WIFE_4	B	D	E	B	B	A
PWN WIFE_5	B	B	B	B	C	C
PWN WIFE_6	F	F	A	B	D	O