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Cash Equivalent versus Market Value An Experimental Study of Differences and Common Principles of Evaluation

by

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Abstract

The paper investigates the problem why the individual task to give the cash equivalent of a lottery, and the evaluation of the same lottery on a double auction market leed to completely different results. In a series of questions the motivational side of the subject is worked up in a way that the response of a cash equivalent and the evaluation of a lottery by a group of players organized via a market only differ in quantity, not in the general approach. Key is a value function which gives the incremental values of assets.

The 'countermoney effect', a framing effect that happened in the considered type of lotteries is worth mentioning. When subjects exclusively play lotteries of a type where they always get a power of ten (here 1000 DM) as payoff with different probabilities, then they analyse the payoffs with an anchor point in the given power of ten. This pattern is as similar as the use of the anchor point 100% for counterprobabilities.

0 Motivation

Motive for the series of auctions of this paper were two questions:

1. why are lotteries evaluated in generally different ways in auctions and cash equivalence experiments,
2. why are low probability lotteries in auctions evaluated lower, when high probability auctions are traded in the same auction, and
3. which phenomena can serve to explain the differences.

In order to approach these problems we ran a series of auction experiments in which lotteries were auctioned under different conditions. Before the auctions were run, we asked the subjects several questionnaires by which we asked for the cash equivalent, and stepwise turned to questions which asked the data of possible calculations related to buying lotteries in auctions.

The result is, that the way from evaluation of lotteries by cash equivalent to the evaluation in auctions can be described as a continuous or stepwise adjustment of the same type of question to a variable number of lotteries on the market, of which the first is evaluated higher than the second, etc. While the reduction of the values of the different lotteries of one type with increasing quantity could be easily modeled (individual evaluation data explain the results of the group experiments), interaction effects over different kinds of lotteries could be shown, the corresponding behavioral motivation seems to be clear, but it is not yet explicitly modeled.

1 The Experiment

Subjects: 16 sujects (students of business administration and economics) participated in a sequence of 38 double auctions. The subjects were participants of a project seminar, who thereafter jointly worked on the data with the aim to model the behavior.

Auctions and assets: The auctions were performed in groups of 4, these groups were mixed in after every round. The assets that were lotteries with payoff 1000 DM or 0, the probability to win 1000 DM was 99%, 90%, 10%, or 1%.

Types of lotteries in the market: We played the conditions that there were all lotteries traded on the market, that there wasonly one of the lotteries traded, or that the 10%-lottery and the 1%-lottery were traded.

Endowments: The subject had an initial endowment of two for each asset on the market, and they had an initial endowment of 10000 DM (when there were all assets on the market), 5000 DM (when there was only one of the two high probability assets on the market, and 1000 DM when there was only one of the low probability assets. – For every auction with 4 types of lotteries the expected value of all lotteries in the market was DM 15.928, the sum of initial endowments of all players in money was DM 40.000. This made sure that all lotteries could be payed. (In fact, at the actual market prices the money endowment of a single player was sufficient to buy more than all lotteries in the market.) There was no shortage of money in the market.

Necessity to sell: the 'normal' situation was that a lottery had no value for the first owner, except she sold it. Thereby we introduced pressure to sell, and caused a high number of transactions of ALL players. Without of this condition trading happens only between pairs of 'extreme players' of which one extremely overevaluates, and the other underevaluates the asset compared to the median evaluation of the group. Moreover, the approach can be described more easily in a theoretical model. The market price for every item the 8th highest of the individual values. (The data show, that – according with the theoretical prediction – the induced pressure to sell did not 'spoil' the result.) The original idea was to have two groups of subjects, buyers and sellers, but we think that we used the subjects more efficiently (and made the auction more interesting) by permitting each of them to take the position of a seller and a possible buyer. (Trading was permitted.)

Opening time: The normal opening time of the market was between 15 and 20 minutes, the end of the time was announced in advance: 'there are between 2 and 5 minutes left', thereafter no further announcement was given, and the end of the market was random after between 2 and 5 minutes. We did so in order to prevent that subjects waited with their transactions until the very last minute. The complete negotiation time was selected such that everybody had enough time to perform all transactions he wanted. This was controled by matching the screen of the double auction market, and waiting with the 2 - 5 minutes announcement until the were by and large no more market activities.

The payoff: The game was actually payed, when a lotto coupon (with a value of DM 500) won, and covered at least DM 55.928. It was made clear in advance that only one of the many rounds that were played could be payed. It was determined after the experiment by lottery, which round would be payed, and which of the auctions of this round was payed first, second, etc. in case that the lotto coupon did not win enough money to pay all auctions of the round. Payoffs below DM 55.928 and above 4 times 55.928 were assigned to other games involving the same subjects. (That only one round was payed avoided that a subject felt to be fed up with lotteries, and hopefully induced the same willingness to buy lotteries in all auctions.) – We think that this kind of approach permits to analyse the decisions as if they were on the high amounts in cash. This has to be verified by corresponding experiments. But even if the verification would fail, I would rather prefer to use this kind of 'as if' construct than to turn to low payoff experiments.[1]

[1]From own negotiations on money amounts which are in the millions of DM I know that I do not imagine the sum, but rather observe the persons who are effected by the consequences of the negotiations, observe their reactions, and by that conclude on the acceptability of compromises. In a similar way men question their own feelings when they make decisions for themselves. These decisions do always have 'as if' character. The decision maker always has first to make the decision, and thereafter gets to feel the consequences. It is part of her task to put herself one or the other as if situation to decide between alternatives. I think that the 'as if' decision in the experiment is only gradually different from the 'as if' decision for real money, namely in so far that the decision maker may not be motivated to imagine the future that intensively, when he does not have to feel the consequences for shure. – But even if the

2 Theoretical Considerations

2.1 Market Prices and Cooperation

In a theoretical approach prices are determined by the reservation prices and the maximal offers (both as functions of quantity). In a simple first approach we assume perfect foresight and complete information.

Under the condition 'no value for first owner' equilibrium prices are in the range between the 8th highest price and the next lower price of another bidder.

Under the condition of 'value for the first owner' the market price is the market clearing price, given by the crossing point of the supply and demand function (if one allows trades and assumes that transactions take place even at epsilon or zero profits, since it can happen that the 'last traded asset' has the same first and last owner). – When trading is not allowed, or trading takes place only under minimal profits, multiple equilibria are possibe, of which the boundaries are determined by the market prices that would form, if the subject who 'buys the last asset' is taken out of the market as a buyer.

Lack of information and lack of foresight bring noise into the system. Expectations have to be modeled. Conservative attitudes towards risk might compensate under the 'value for first owner' but lower the market prices for the 'no value for first owner' condition.

Cooperation of the buyers is in general possible. It is supported by the double auction procedure, since all offers are open so that underbidding is instantly detected, and can be answered by a 'price war'. It is easy to model the market in a way that cooperation is in equilibrium, by withdrawing to the competitive prices when cooperation is not kept. Reduction of prices by cooperation makes sense as long as the gains by reducing the price are higher than the losses by reduction of the number of assets a player gets, this condition has to hold for every single player. (A model using the probability to get an asset instead of the actual transfer of assets can also make sense. It leeds to lower market prices since compensation is only necessary in the long run.) It is easy to see that the cooperative equilibrium is usually not at zero prices, if one expects that at zero prices all players have the same probability to get an item (what behaviorally makes sense). But also tricky rationing schemes cannot help as long as there are players, who do not get their equilibrium payoff, and can increase the number of (profitable) assets they get by increasing the price.

reader does not agree in this point, he might agree with me that it is better to perform high payoff 'as if' decisions than real low payoff decisions. The reason why we do not play the latter, is that we know that for low amounts utility on the money scale is highly perturbed by different kinds of risk loving, and we clearly do not want to model these effects here.

In the experiment the division of surplus (governed by the distribution of assets) can create problems since communication is not possible. This might essentially restrict possible cooperation from a practical point of view.

The data of the experiments indicate that there was no cooperation in the considered auction markets.

2.2 The Effect of Quantity on the Value of Risky Assets

The Portfolio-Hypothesis says that risky assets that are bought at the same time are evaluated as a bundle, so that for example 5 assets of the same kind have less than five times the value of one such asset. This hypothesis is theoretically motivated if one assumes decreasing returns to scale on the different dimensions in which the utility of an asset is measured.

The assets here are lotteries, 'classical theory' evaluates all of them by their expected value, it is obvious that these values are additive so that ten assets have ten times the value of one asset. May be that at least part of the nonlinearity in the evaluation of lotteries is induced by hope and fear, and by other emotions that are connected with the perception of risk. This raises the question whether it is possible to identify a 'pure value', which remains after subtracting the emotional components of evaluation, whether the emotional components disappear when more than one asset can be bought at the same time, or when lotteries are traded as assets, if the 'pure value' is induced by auction markets, and if the 'pure value' has a different, may be even additive character.

2.3 The Aggregation Problem

An interesting feature of the evaluation of risky portfolios is, that subjects tend to isolate problems and evaluate these isolated problems, and do not apply an wholistic approach which evaluates problems within a general streem of decisions. Different kinds of isolation are possible

(A1) ('complete isolation') every single lottery is considered separately
(A2) ('isolation of types of lotteries') aggregation of all lotteries of the same type (same payoff, and same probability to win)
(A3) ('auction portfolio effect') aggregation of all lotteries that are involved in the same auction
(A4) ('experiment portfolio effect') aggregation of all lotteries that are involved in the same series of experiments
(A5) ('life portfolio') aggregation of all lotteries of a series of experiments together with the other unsolved risks and problems of the present moment of life

In advance we mention the initiation effect, which says that risky alternatives are erased from the present portfolio as soon as the risk is solved. I.e. a jointly evaluated portfolio only considers unsolved lotteries. This effect is supported by the experiments of SELTEN, SADRIEH, ABBINK (1995), in which subjects went through about hundred rounds of risky decisions and showed the phenomena of well known paradoxa, although the expected value could be selected as a decision criterion, was even available by simply pressing a button. The experiment seems to support the initiation effect.

The approach here selected single rounds, of which only one could be payed. The idea was, thereby to induce subjects to consider auctions as units, and not to make tradeoffs between different auctions since only one of them could be selected. In fact the induced situation is a big lottery, where with anticorrelated events. Our impression is that the subjects did not aggregate over different auctions, according to our intentions.

That aggregation over different rounds of a series of experiments is possible can be seen from the experiments of POTTERS (1996). It can also be seen from the data of this experiment: in the beginning of the experiment it happened that not all subjects had perceived the instruction that only one round would be selected to determine the payoff. This caused decreasing willingness to take risk, which can be seen from the low values of the 1%-lottery in rounds 7 and 8 of the first day. We want to mention the effect, but do not want to go into further details. We should however mention that after informing the subjects we thereafter observed a by and large stable behavior of the subjects over 2 days of experiments (see for instance the results of identical types of auctions in rounds t24_04, t24_05 and t25_03 which were played on different days (the first two numbers denote the day, the other two the round), so that we dare to say that subjects did not aggregate over the whole series of experiments. In this context we mention the experiments of SELTEN, SADRIEH and ABBINK (1995) who played as far as I remember far more than 50 rounds of different kinds of auctions as preference reversal experiments, gave the subject their payoff after evry round, and had no aggregation effect over rounds.

We did not control whether the unsolved risks and open problems of the life effected the decisions, although we know from other investigations that they do. (See for instance ALBERS, POPE, SELTEN 1998.) Here we take the position that we are only interested in ceteris paribus effects.

We controlled the aggregation of identical types of lotteries within one auction by asking the subjects (via strategy method) how much they would bid on the first, second, ..., fifth lottery of the same type. The result is as follows: (1) For the 1% lotteries played under the condition 'only one type of lottery on the market' the aggregated bahavior fits to the values the subjects give in the questionnaire. In fact this holds for two different degrees of experience, in the very first round of auctions, and in a later round with experinced behavior (these were the two situations where subjects evaluations had been raised). These analysis could not be performed for other lotteries, since we did not pick up the data under the 'only one type of lottery on the market' condition. (2) The prediction for the 90%-lottery in the auctions where all types of lotteries are traded works under the assumption that subjects evaluate 90%-lotteries as if 99%-lotteries were of the same type (so that they add up the numbers when they buy 90induces prices as if the double quantity of 90%-lotteries were sold. (3) The prediction of the 99%-lotteries slightly overevaluates the values obtained on the market where all assets are traded at the same time. (All predictions by equilibrium approach, and not assuming cooperation.)

All three results indicate that the equilibrium approach is correct, and that cooperation does not happen. As mentioned above, it was probably too difficult to agree on division schemes tacidly.

We now come to the aggregation effect over all assets involved in one auction. (1) As already mentioned, the 90%-lotteries seem to be ranked after the 99%-lotteries and evaluated as if they were in the sum position. (2) The other effect is that the 1%-lotteries are essentially devaluated when they are traded in the same auction together with the other lotteries.

2.4 Cash Equivalents, and Countermoney Effect

The theory of prominence predicts that payoffs are perceived on a quasi logarithmic scale given by the full step numbers $a * 10^i$ ($a = 1, 2$, or 5, i integer). On this scale the difference of numbers is perceived and measured in full steps, between full steps we assume linear interpolation. To be able to measure distances to the 0-point and negative numbers, perception is restricted by a finest perceived full step number which depends on the given task, and is evaluated as one step above 0. – The finest perceived full step on the money scale (FPFM) is the crudest full step number that is at least two steps below the greatest absolute amount of the payoffs involved in the task. (In case that a lottery between payoffs 0 and 1000 is considered, the FPFM is 200.) – The evaluation of probabilities is also induced by steps of a scale on which probabilities and counterprobabilities are perceived, and on which again the finest perceived full step of probability (FPFP) depends on the probabilities involved in the given task. By empirical investigations we found that 10% and 90% are perceived on a scale with FPFP=5%, which creates the probability scale 0counter-probability scale 50% – 20% – 10% – 5% – 0% (which are the probabilities 50% – 80% – 90% – 95% – 100%). Stitching the two scales in 50% gives the total scale 0% – 5% – 10% – 20% – 50% – 80% – 90% – 95% – 100%. On this scale 10% and 90% are perceived, what gives 2 of 8 steps (= 2/8 = 1/4) for 10%, and 6 of 8 steps (= 6/8 = 3/4) for 90%. The value of 1% and 99% is obtained under a different FPFP, namely FPFP=1% which gives the scale with the full steps 0% – 1% – 2% – 5% – 10% – 20% – 50% – 80% – 90% – 95% – 98% – 99% – 100% which again is constructed via probabilities and counter-probabilities which are perceived with identical FPFP, and stitched in the 50% point. This gives 1 of 12 steps (= 1/12) for 1%, and 11 of 12 steps (= 11/12) for 99%. (In a corresponding way one obtains that 50% is evaluated as 1/2, for further values see ALBERS 1998.VI) – The perceived values in the step space (= perception space) are denoted as $per(x)$ for money amounts, and as $p_i(p)$ for probabilities. – The value of a lottery which gives payoffs x_i with probabilities p_i in the perception space is $\sum_i x_i * p_i$). The empirical evidence of this approach has meanwhile been checked in several investigations concerning very different tasks as the evalution of prospects with two components (see ALBERS 1998.VI), the characterisation of fairness criteria in equilibrium point selection (see VOGT, ALBERS 1997), the detection of new and explanation of old paradoxa of prospect selection, as preference reversal (see ALBERS 1997.IV), and others.

The surprising and new result of the investigation here is a phenomenon that we had already observed before in some extended self analysis of the evaluation of prospects with payoff alternatives 10^i (i integer) and 0 when high probabilities (near 100%) were asked. The phenomenon is the

> 'countermoney-effect': When subjects have to evaluate simple lotteries (where the payoff is 0 for one alternative, and an integer power of 10 for the other) then they tend to transfer the idea of counterprobabilities to the money scale by using the high payoff as an anchor point. The FPFM is obtained in the same way as before.

The paper here supports the countermoney-effect by two different results: 1. the observed evaluations of the prospects support the effect, and 2. the model that describes influences of different types of auctions on the market prices by discounts becomes a general shape if the dicounts are measured in steps and if one assumes a structure according to the countermoney effect.

2.5 Cash Equivalent versus Auction Value

The evaluation of prospects can essentially depend on the situation. We developed a special procedure to obtain cash equivalents. The subject is asked to imagine the given lottery to be in a table in front of her, and to imagine a money amount on the other side of the table. She is asked, for which money amount she is indifferent whether she receives the money amount or the lottery. Under this condition, the cash equivalents can be predicted by the theory of prominence.

The empirical evidence of the experiment here shows that the evaluation of prospects in an auction where several lotteries of the same type can be bought seems to be motivationally different. For low probability lotteries the values drop clearly below the expected values while the cash equivalents were given by the same subjects as far above the expected value. The overevaluation of small probabilities (as happening in the evaluation tasks and modeled by the theory of prominence) disappears under market conditions.

In the investigation here we can see that the evaluation of the lotteries is in the beginning induced by the cash equivalent, and shifts with increasing experience (5 rounds of negotiations) to the auction value, which then is then stable for the rest of the experiment.

3 Discussion of the Results

3.1 The Countermoney-Effect of the Money Equivalent

The money euivalents were raised before the auctions took place. Accordingly, the perception was not yet transformed by the auction situation. The subjects gave higher and lower bound of the indifference region of their money equivalents. Table 1 shows the medians of these values.

Table 1: Money Equivalents Evaluation of Lotteries [$10^i(p)$], p=99%,90%,10%,1%
-- Predictions by Different Theories and Experimental Results

probability (of lottery)	99%	90%	10%	1%
prediction via				
(e) expected value	990	900	100	10
theory of prominence				
(o) anchor=0 0-200-500-1000	875	625	150	50
(a) anchor=1000 0-500-800-1000	950	850	375	150
questionnaire result for	(b) (a)	(b) (a)	(b) (a)	(b) (a)
payoff (of lottery) 10000 DM	950 900 a	800 700	100 70 e	10 8.5 e
1000 DM	970 925 a	825 700	200 100 o	75 27.5 o
100 DM	950 900 a	860 775 a	300 125	100 50
10 DM	990 950 ae	900 800 ae	400 250 a	200 100 a

1) (a)- and (b)-value are the upper and lower bound of the range of indifference
2) these experimental results were raised before all auctions

It can be seen that for very low money amounts the theory of prominence with anchor point in the possible gain 10^i is the best predictor (surprisingly, the expected value succeeds for high probabilities, but completely fails for low probabilities). For the money amount that we mainly considered in the investigation, DM 1000, the best predictor is the given by the theory of ptominence, where the anchor point switches from 1000 (for high probabilities to 0 for low probabilities. This makes sense, since for high probabilities as 995 or 90% the decision maker thinks about the counterprobabilities, and the reduction of the total value of 1000. For DM 10000, the highest money amounts of the table, the expected value becomes important for low probabilities. The risk loving motivation induced by the to win and the fear to give away the chance changes in favor of a more cautious calculation, which is for low probabilities oriented at the expected values (for high probabilities it is just a small further reduction of the proportion). The interesting phenomenon is that comparatively high changes happen only for low probabilities, where the expected value concept can motivate a high reduction.

The general principle that guides the behavior may be in one word: increasing caution, decreasing optimism about own chances with increasing amount of money involved.

3.2 Sensitivity on Money Endowment

In the following only lotteries with 1000 DM payoff will be considered. We asked the subjects, how much they would at most pay for the 90%- and the 1%-lottery under different money endowment conditions, namely 5000, 1000, and 0 DM. It could be expected that the values would decrease with decreasing endowment. This was the first question which did not ask for an exchange value, but for the buying situation, but this did not cause any effect in the contain the preceding values). The restriction of endowment, that money comes from a limited account was introduced for the first time. In the conditions with low endowment of 1000 DM and 0 DM the values are essentially reduced. For the lotteries with low probabilities values far below the expected value result when there is no money endowment: half of the subjects do not want to spend 1 DM for the 1%-lottery.

Table 2: Evaluation of [1000(p)] 1) for Different Endowments with Money

probability (of lottery)		99%	90%	10%	1%
endowment:	5000 DM	910/950 2)	800/850	100/150	10/20
	1000 DM	900	600/800	100	10
	0 DM	700	400/500	20	0/1

1) maximal willingness to pay, the entries are medians.
2) two values denote upper and lower median

3.3 Maximal Buying Prices of Multiple Assets

The next aspect is, how subjects change their evaluation when they consider to buy several lotteries of the same kind. We asked the subjects for the maximal prices they were willing to pay for the first, second, ..., fifth lottery.

These data have been picked up two times. The first time was right after the other questionnaires, the other at the beginning of the second day, after the subjects had taken part in all auction rounds.

The given values were used to determine a 'market price' under the assumption that no subject bought more than 5 lotteries (what conforms with actual behavior) and that 32 lotteries were bought on one market (in fact the market was split up into 4 markets in each of which 4 subjects participated, and 8 lotteries were sold, the ratio is the same). The result can be compared with the median actual price that formed on the 4 markets.

Table 3: Maximal Buying Price of the First, Second, ... Lottery (Median Values)

probability (of lottery)	99%		90%		10%		1%	
time	1	2	1	2	1	2	1	2
maximal price paid								
as 1st lottery	900		725				35	
as 2nd lottery	900		700				32.5	
as 3rd lottery	900		610				10	
as 4th lottery	900		600				10	
as 5th lottery	850		600				4	
thereby induced market price in auction 2)								
32 lotteries, at most 5	910		700				20	
64 lotteries, at most 10	900		620				10	
actually observed median price in auction								
1 type of lottery in mark							11	7.5
2 types of lotteries ...					70	-	8.5	-
4 types of lotteries ...	870,880		620,650		40	50	4	3.5
questionnaire after the experiments								
maximal price paid								
as 1st lottery				850				8
as 2nd lottery				820				7.25
as 3rd lottery				800				6.5
as 4th lottery				775				5
as 5th lottery				750				5
thereby induced market price in auction: 2)								
32 lotteries, at most 5				820				7
64 lotteries, at most 10 3)				800				6

1) all lotteries bought under an endowment of 5000 DM

2) market price under the assumption that all lotteries are traded on one market, and the 32nd highest price determines the market price.

3) The subjects gave answers up to the 5th lottery, the answers up to the 10th lottery are estimated by completing the first series in a kind of quadratic regression using the same exactness of responses as before.

The result is that the actual behavior does not fit badly to the responses of the first questionnaire. The assumption that the subjects do not consider lotteries isolatedly, but consider 99%-lotteries and 90%-lotteries together, or 90%-lotteries as second choice after 99%-lotteries improves the prediction compared to the result. A similar effect holds for the 1% lottery. Assuming that they are treated as if double the quantity has to be bought (which could be a reasonable approach assuming that 1%-lotteries are ranked after the 10% lotteries, but are comparable with them) improves the fit. Generally there seems to be some devaluation of lotteries compared to the assumption that every type of auction is evaluated isolatedly. We cannot decide whether this reduction is induced by the porfolio effect, or by the fear of subjects not to sell their lotteries when they are too cautious in selling. – The highest effect reduction (compared to the isolation price) can be observed for the 1%-lottery when it is traded in the same auction as the other three lotteries. In this situation the price of the lottery clearly drops down, which may be clearly identified as a portfolio effect.

The questionnaire after all auctions was raised after the second price auction and the buyer seller game. These data do not any more conform with the behavior in the auctions with 'no value for first owner'. They conform with the data of the last kind of auction played before the second questionnaire was presented, in which second price auctions, and buyer seller games were played. This gives the general impression that evaluation of prospects is not based on firm individual 'utility functions', but rather casually constructed.

Our speculative idea is that decisions are not governed by 'utility functions' which can be picked up by the experimenter, but that decision processing rather follows a process, where in the first step some uncontrolled internal mechanism produces suggestions of solutions, and in step two the rational part of brain tries to support this result with schemes of reasoning. In case that the reasoning does not leed to contradictions, the proposed solution is accepted. – transferring this idea to the approach here, the respective present approach is modified, when 'contradictions' occur. For example, the high evaluation of low probability prospects in the cash equivalence condition seems to cause contradictions in the auction condition, and in the low endowment condition. The theory of prominence seems to give the pre-adjustment which is revised when the circumstances show contradictions.

4 Answers to the Questions of Section 2

4.1 Cooperation

Little can be said about cooperation. The data of the individual evaluations of the 1st, 2nd, ...lottery permit to compute the theoretical effect that is possible by cooperation. In the majority of cases there is no such effect, in the other cases the effect is induced by the step structure of the given responses: since subjects usually answered in multiples of 100 (for the high value lotteries), prices as 650 are not frequently selected, and it can make sense to reduce the price from 700 to 650 cooperatively. However, we presume that in the actual auction plaers might bid more sensefully, so that the step structure (and thereby the effect) disappeares. The data here do ot permit to make a cooperation effect significant.

4.2 Auction Values versus Cash Equivalent

The suggestion of a special 'auction effect' that shifts principles of evaluation can be confirmed. The effect does not need the auction procedure, but already shows when

Table 4: Frequencies of Different Contracts by Types of Lotteries, Normal Condition

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          99%-lottery                      90%-lottery                      10%-lottery                          1%-lottery
  700  750  800  850  900  950 1000   400 500 600 700 800 900 1000   0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5>5 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5>5
   +----+----+----+----+----+----+   +---+---+---+---+---+---+---+   +---------+---------+---------+..  +---------+---------+---------+..

NORMAL (LOTTERY OF NO VALUE FOR FIRST OWNER)
--------------------------|---------------------------|---------------------------|------------------------------|-------------------------
t24_04 3    .    11   5 32331   .    : * .    .   1 1 7344.   .   .   :   * : 14. 1 426 . . . . : . . . . . * : 5 2 312 1 1 11221 1 . . . . . *
       .    .    :    . N|  .   .    : * .    .   :   .N| .   .   .   :   * : . . . N|. . . . : . . . . . * : . . .|N . . . . . : . . . . . *
t24_05 2    21   2521121  | .25621   : * 31   21  1   252X44 3 .  .   :   * : 236221. 642 2 . 1 2 1 . 1 1 1 * :1C 7 2 223 1 2 . . 1 . . . . .<2>
       .    .    :  (N)   | .   .    : * .    .   :   . .N .  .   .   :   * : . . . .|N . . . : . . . . . * : .(N).|. . . . . . : . . . . . *
(it is not sure whether on the first day all subjects really aware that only one round would selected to be payed (the instuctions said this),
we therefore use only the data thereafter for further analysis)                        |                              |
t25_03 .    1    541 11313341 1321   : *<1>   .   :   6XX16311.   .   :   * : . 223 2 X2831 . . : . . . . . * : 2 3 74112 7 2 .2. : . . . . . *
       .    .    :    . N  .    .    : * .    .   :   . N  .  .   .   :   * : . . . .|N . . . : . . . . . * : . . .N. . . . . . : . . . . . *
--------------------------|---------------------------|---------------------------|------------------------------|-------------------------
sum    3    1    651 16345672 1321       41   21  2 1285490341              3784616226033   1 2 1   1 1 1   10 2 25536 9 51241 2             2
                   <-----N-->                     <-N>                      <----N>                          <--N---->

NORMAL (LOTTERY OF NO VALUE FOR FIRST OWNER), TWO ASSETS IN THE AUCTION
--------------------------|------|--------------------|------|--------------------|----|------------------------|----|--------------------
t24_03 .    .    :    .   | .    .   : * .    .   :   .|  .   .   .   :   * : 3131.1.14 2 1 2374: . . . . . * : 1 . . 3 3 3 .211716 . . . . . *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .   .   :   * : . . . .|. . n . . : . . . . . * : . . .|. . | . .nn . . . . . . *
--------------------------|------|--------------------|------|--------------------|----|------------------------|----|--------------------

NORMAL (LOTTERY OF NO VALUE FOR FIRST OWNER), ONLY ONE ASSET IN THE AUCTION
--------------------------|------|--------------------|------|--------------------|----|------------------------|----|--------------------
t24_01 .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .|. . | . 1 3 8 6 4 1 1 8 *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .|. . | . . . : n . . . . *
t24_02 .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . . 1 1 2 411 92X 7 4 . . . *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .|. . | . . .nn . . . . . *
t24_07 .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * :12 3 322141. 2 112 4 1 3 . . . *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .|.(n)| . . . : . . . . *
t24_08 .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . *<1>52617 1 4 . 43521 : . . . . . *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . .(n). . | . . . : . . . . . *
(it is not sure whether on the first day all subjects really aware that only one round would selected to be payed (the instuctions said this),
we therefore use only the data thereafter for further analysis)                   |    |
t25_01 .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .171415 65153 6 5 1 . . 4 *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .|. . | .n. . : . . . . . *
t25_02 .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . . . 2 3 51D12 4 3 2 1 4 1 1 *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .|. . | n . . : . . . . . *
t25_04 .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . 1 . X284641 1 3 . . . . . *
       .    .    :    .   | .    .   : * .    .   :   .|  .   .|  .   :   * : . . . .|. . | . . : . . . . . * : . . .|. . n . . . : . . . . . *
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exemplary of a type has a price which confirms with the money equivalent, and this price stepwise drops. The set of ordered prices induces market prices on the auction market, which correspond to the observed data. This gives us the main result of the paper

> the difference of money equivalent and auction prices is induced by the fact that subjects evaluate second, third, etc. lottery of a portfolio in a decreasing way.

(As the arrangement of the experiment – with sufficient money endowment – suggests the reduction of prices on the auction market (considered here) is not induced by shortage of money.)

4.3 Level of Aggregation: The Auction Portfolio Effect

As mentioned in Section 2, the approach that the different lotteries are aggregated separately in classes of lotteries can be clearly rejected for the 1% lottery, mainly by the effect, when it is traded together with all other lotteries. (It is a pity that – by lack of time – we did not check the effect for the other lotteries without time pressure.)

Interesting to mention is, that the effect is clearly weaker under 'time pressure', but nevertheless can be confirmed for the 90%-, 10%-, and 1%-lottery.

Over all we get the result that the experimental observations (related to some misunderstanding in the first rounds) that there is an experiment portfolio effect (A4). However the experiment was not meant to adress this question. In contrary, by the payoff procedure (selecting only one round to be payed), we excluded the experiment portfolio effect, and thereby could check how the different lotteries of an auction are aggregated. The result is that there is an auction portfolio effect (A3), and that the hypothesis that lotteries are aggregated only typewise (A2) is too strict.

In spite of these findings it must be mentioned that there are subjects who seem to evaluate given lotteries as they are, and do not reduce the marginal value for additional lotteries of the same kind (up to four lotteries of the same kind). These subjects seem to fulfill condition (A1) to a certain extent. This however does not meen that the same subjects do not show portfolio effects (A2) (but we did not check that by our data).

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