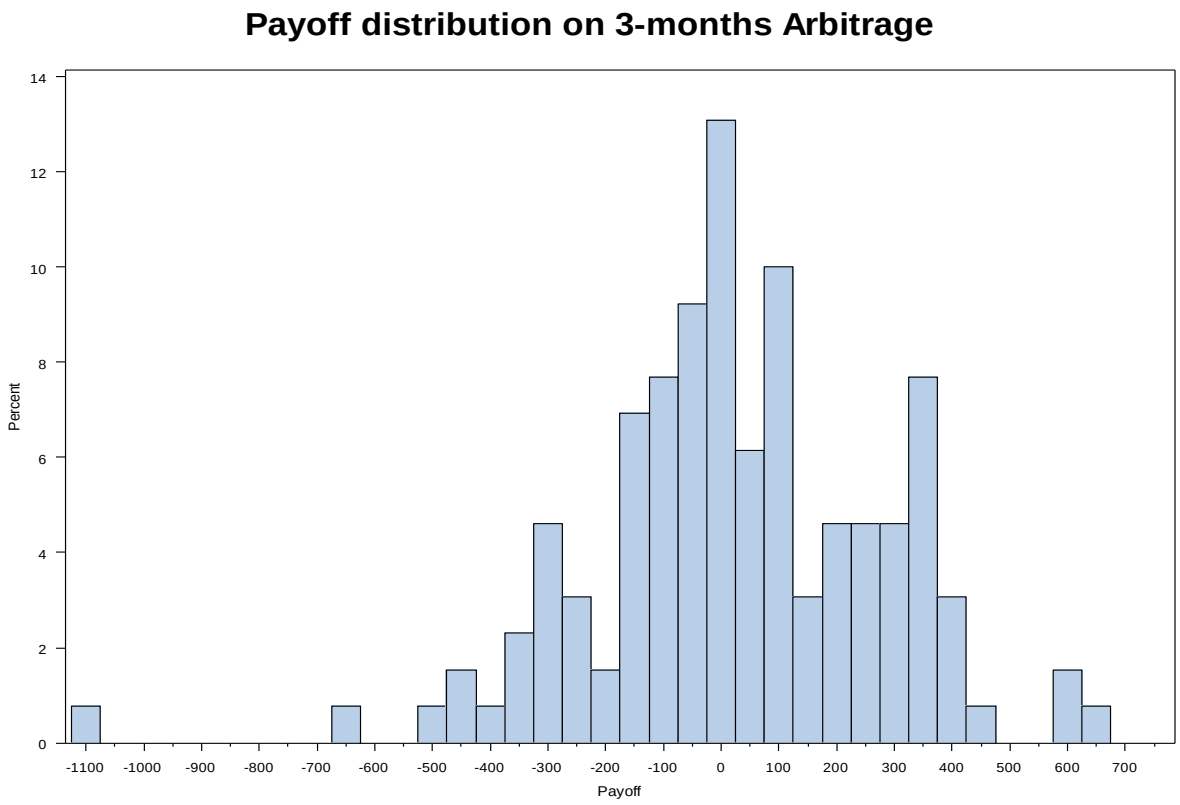
Supplements to "Short-run Arbitrage in Crisis Markets"

Supplement A: TA100 and TA220 Data

The table presents the monthly changes in TA100, TA220 and TASE from July 2007 until March 2009. The column "#Participants" provides the number of portfolios collected in each month and the column "Payoff" denotes the mean (median) payoff on the corresponding portfolios.

	TA100	TA220	TASE	# Participants	Payoff
JUL 2007	-0.19%	-0.55%	0.18%		
AUG 2007	-3.8%	-4.00%	-3.95%		
SEP 2007	3.23%	2.62%	1.24%		
OCT 2007	6.49%	6.35%	4.94%		
NOV 2007	-3.66%	-3.92%	-4.01%		
DEC 2007	1.9%	1.21%	1.27%		
JAN 2008	-13.8%	-13.8%	-12.7%		
FEB 2008	3.04%	2.92%	4.46%		
MAR 2007	-10.2%	-10.3%	-9.60%		
APR 2008	5.52%	5.25%	4.72%		
MAY 2008	4.57%	4.36%	2.81%	13	-17 (17)
JUN 2008	-4.81%	-5.79%	-3.18%	30	30 (10)
JUL 2008	-3.99%	-3.93%	-4.68%	19	-46 (-28)
AUG 2008	-3.14%	-2.99%	-2.28%	6	270 (287)
SEP 2008	-11.6%	-11.7%	-11.0%	20	59 (10)
OCT 2008	-19.7%	-19.8%	-17.5%	13	89 (67)
NOV 2008	-8.17%	-8.17%	-5.83%	21	-34 (12)
DEC 2008	-0.7%	0.86%	-1.92%	8	60 (57)
JAN 2009	2.59%	2.75%	4.21%		
FEB 2009	1.01%	1.04%	5.48%		
MAR 2009	14.87%	14.93%	10.37%		

Supplement B: Payoff Distribution



Supplement C: Regressions on Arbitrage Payoffs

List of Main Explanatory Variables Tested in the Regressions:

TA_220 – the change in TA220 index along the 3-months arbitrage

DATE- Participation date (in SAS numeric representation)

AGE

GENDER- 1 for male

EXPERIENCE- years of experience holding a money-management or consulting job in the financial industry

FAMILIARITY- subjective ranking of "familiarity with the Israeli stock market (prices, returns etc)" in 1-7 scale

THEORY- subjective ranking of "theoretical knowledge in finance (academic courses, literature etc)" in 1-7 scale

EDU- Years at school (including current academic year; 12 years represent standard high-school education)

MBA- Indicator for having or pursuing MBA degree

HIGH_EDU- Indicator for EDU≥16

T(ARB)- Time spent on the 3-mon arbitrage screen (the screen where subjects submitted their transaction)

T(INTRO) – Time spent on the introductory pages 2 and 3 introducing the concept of arbitrage in expectations (we omit the other time counters that did no show significance)

TA100 – Expected return on TA100 in the 3-mon arbitrage period: **1**=increase of 10% or more **2**=increase of 5% to 10% **3**. Increase of 0 to 5% **4**. Decrease of less than 5% **5**. Decrease of 5% or more

#LOGINS – Number of logins to complete the experiment: taking the values 1 to 4 (truncated at 4)

QUIZ – Number of correct answers minus number of wrong answers in the trivia familiarity quiz (unanswered questions are counted as 0)

CONF – subjective assessment of the probability that the selected arbitrage portfolio would earn a positive payoff

RISK_AVERSE – Three binary choice problems are used to assess individual risk aversion in gains domain. In Problem 1 subjects are asked to choose between a lottery

paying 200 or 50 NIS with equal 50% chances and a certain payoff of 155; in the second problem the certain alternative decreased to 125; in the third problem the certain alternative decreased to 95. RISK_AVERSE denotes the number of problems where the subject preferred the lottery over the certain payoff.

LOSS_AVERSE – Three binary choice problems are used to assess individual risk/loss aversion when losses are possible. In Problem 1 subjects are asked to choose between a lottery paying +200 or -50 NIS with equal 50% chances and a certain payoff of 95; in the second problem the certain alternative decreased to 75; in the third problem the certain alternative decreased to 55. LOSS_AVERSE denotes the number of problems where the subject preferred the lottery over the certain payoff.

DEPOSIT – Amount invested in Deposit

LOAN – Amount of loan

IND_DEPOSIT- Indicator for investing in deposit (the indicator were used in the logistics regressions while the quantities were used in the linear regressions; this improves the significance of the deposit/loan variables).

IND_LOAN – Indicator for borrowing funds by loan

The next table presents the mean, median and standard deviation of each variable and summarizes the results of preliminary linear (logistic) regressions on the complete list of variables specified above. The maximal level of correlation between the explanatory variables included in the analysis is 0.65 – which is the correlation between “FAMILIARITY” and “THEORY”. The minimal level of correlation=-0.26 is for "EXPERIENCE" and "CONF". The dependent variable in the linear regression is the return on the arbitrage in percentile form (R). The table also presents the results of the linear/logistic estimations after applying iterated backward removal of the insignificant coefficients up to the step where the all remaining variables are statistically significant at $p<0.1$. In the logistic regressions, negative coefficients represent a decrease in the probability of positive arbitrage return.

Variable	Mean/ Median (STD)	Linear Regression (LR)	LR with Backward selection	Logistics Regressions (LogR)	LogR with backward Selection
TA_220	-16.5/-18.5 (11.4)	-0.03* (0.02)		-0.07 (0.15)	
DATE	6/ 18 AUG (65.5)	0.01* (0.04)		0.006* (0.004)	0.005* (0.003)
AGE	32 / 29 (8.6)	-0.17 (0.29)		0.02 (0.03)	
GENDER (male=1)	89% male	0.44 (6.7)		0.22 (0.69)	
EXPERIENCE	1.99/1 (3.2)	0.41 (0.8)		0.06 (0.09)	
FAMILIARITY	4.5/5 (1.3)	-0.33 (2.3)		-0.27 (0.25)	
THEORY	4.6/5 (1.3)	0.33 (2.6)		0.38* (0.28)	
EDU	16.4/17 (1.9)	-0.67 (1.0)		-0.22** (0.11)	-0.09** (0.04)
MBA	57%	0.2 (4.7)		0.37 (0.5)	
T(INTRO) (in seconds)	269/178 (258)	-0.014** (0.008)	-0.016** (0.007)	-0.0002 (-0.0009)	
T(ARB) (in seconds)	716/276 (2550)	0.0002 (0.0009)		0.0002 0.00025	
TA100	3.3/3 (1.4)	1.1 (1.7)		0.13 (0.16)	
# LOGINS	2.3/2 (0.97)	1.3 (2.2)		-0.07 (0.22)	
QUIZ	-0.7/-1 (1.55)	-0.8 (1.4)		-0.07 (0.15)	
CONF	54/60 (25)	**0.21**** **(0.09)**	**0.16**** **(0.047)**	0.01* (0.009)	0.01* (0.0078)
RISK_ AVERSION	1.3/1 (.6)	-1.5 (3.7)		0.09 (0.4)	
LOSS_ AVERSION	1.4/1 (.8)	3.8 (3.1)		0.57 (0.32)	-0.54** (0.25)
IND(DEPOSIT)	18%	–		0.92** (0.65)	0.033** (0.0019)
IND(LOAN)	16%	–		**-2.5**** **(0.79)**	**-0.003**** **(0.001)**
DEPOSIT	85 (236)	0.021** (0.01)	**0.023**** **(0.009)**	–	
LOAN	116 (298)	**-0.029**** **(0.075)**	**-0.0315**** **(0.007)**	–	
R^2	–	0.31	0.27	–	–

Supplement D – Detailed analysis of stock selection long vs. short

About 63% of the stocks in TA220 (139 stocks) were selected for purchase or sale along the experiment. Stock selection was relatively focused on the buy side where subjects picked only 84 stocks, less than 40% of the menu. Larger diversity is observed on the sell side where the participants selected 112 distinct items from the list (51%). The more focused selection on the buy-side is underlined by tendency of participants to buy more stocks than they sell. The total number of stock-purchases (294) was larger than the number of short-sales (269) and only 19 participants sold more stocks than they bought.[1] Each of the 84 stocks in the purchase list was therefore selected 3.5 times (on average), while the 112 stocks in the short-sell list were only selected 2.4 times each.

When participants that sold the stock that attracted the largest volume of sale (6.4% of total sell-side volume) are removed from the sample, the mean arbitrage return increases to 3.5% and the median rises to 2.2% ($N=115$; $p<0.05$). When subjects that bought the stock that attracted the largest volume of purchase (7.7% of total buy-side volume) are excluded as well, the mean return increases further to 3.9% while the median climbs to 4% ($N=96$; $p<0.05$). Significance is maintained in various other sensitivity analyses; e.g., when portfolios that selected 1 of the 3 stocks that contributed the largest average gain or 1 of the 3 stocks that brought the heaviest average loss are ignored, the sample size moderately decreases to $N=120$, the mean arbitrage return increases to 3.4% and the median rises slightly to 2%.[2]

To test if the accumulated volumes of purchase or sale could be used to identify purchase or sale opportunities, we examine the correlation between volumes of trading and eventual returns. First, we compute the correlation between net volume of purchase (total volume of purchase minus total volume of sale) and volume-weighted buy-side return, for the 84 stocks selected for purchase. The Pearson coefficient of correlation is positive 0.22 and the Spearman rank correlation is 0.32. The mean (buy-

[1] The number of stocks selected (long and short) did not affect performance consistently.

[2] The average return on each stock is separately calculated for the buy-side and sell-side. The average buy-side return on a given stock is the volume-weighted average of the returns earned by participants that purchased the stock. Sell-side returns are calculated similarly. The sample of 120 portfolios is obtained when portfolios that (bought 1 of the 3 strongest or 1 of the 3 weakest stocks in the buy-side) or (sold 1 of the 3 strongest or 1 of the 3 weakest stocks in the sell-side) are removed from the sample.

side) weighted-return on the 20 stocks that attracted the largest net-volume of purchase was -17.3% compared to mean weighted-return of -34.1% on the 20 stocks that drew the lowest net-volume of purchase ($p<0.01$).[3] The stocks that attracted larger volume of net-purchase therefore showed stronger resistance to the crisis. The 5 stocks that drew the largest net volume of purchase, in particular, declined by a relatively modest rate of 8.8% along the corresponding arbitrages. Next, we run similar analysis on the 112 stocks that were selected for short-sale. The Pearson correlation between the net volume of sales (total sales minus total purchases) and weighted sell-side return is 0.09 and the Spearman rank correlation is 0.21. Again the data confirms that larger net sale volumes are associated with larger returns. The mean (sell-side) weighted-return on the 20 stocks that drew the largest net-volume of sale was +34.5%, compared to mean return of +17.2% on the 20 stocks that obtained the lowest net-volume of sale ($p<0.01$).

Table D splits the collection of stocks selected along the experiment into 3 distinct categories. The "BUY-and-SELL" list includes the stocks that were traded on both sides of the arbitrage (bought and sold at least once by different participants). The "BUY-ONLY" list includes the stocks that were selected long but never selected short. The "SELL-ONLY" list similarly refers to the stock that were sold-short but never purchased. The table compares subjects' performance with the stocks that were only traded one-side to their performance with the stocks that were traded on both sides. The comparison is separately run for long-side (left-panel) and short-side (right panel) transactions. The upmost panel summarizes the results for the complete sample (N=130). The %(trading-volume) figures interestingly reveal that most of the experimental trading (81% of buy-side volume and 60% of short-side volume) involved the 57 stocks composing the BUY-and-SELL list. Stock-selection along the experiment therefore did not separate the "stocks for purchase" from "stocks for sale"; only 20% of the trading was performed with the stocks composing the BUY-ONLY or SELL-ONLY lists. The stocks that were only selected on one side of the arbitrage exhibit stronger performance relatively to the stocks that were traded on both sides, but most of the differences are insignificant. The mean volume-weighted loss on the 27 stocks composing the BUY-ONLY list, for example, was -18% compared to mean

[3] The mean weighted-return for several stocks is calculated using a simple average, but the results do not change much when weighted averages (of weighted returns) are employed instead.

weighted-loss of -23% on (buy-side transactions with) the 57 stocks composing the BUY-AND-SELL list (p=0.18; N.S.).

Table D: Separating stocks by type of transactions [a]

	Long-side comparisons		Short-side comparisons	
Complete Sample (N=130)	**BUY-ONLY**	**BUY-and-SELL**	**BUY-and-SELL**	**SELL-ONLY**
Number of stocks	27	57	57	55
%(Trading-Volume)	11%	81%	60%	29%
Mean weighted-return	-18%	-23%	17%	18%
Mean %(R>0)	25%	17%	78%	88%
Return>0 (N=71)	**BUY-ONLY**	**BUY-and-SELL**	**BUY-and-SELL**	**SELL-ONLY**
Number of stocks	23	32	32	43
%(Trading-Volume)	36%	50%	51%	46%
Mean weighted-return	-10%	-19%	22%	29%
Mean %(R>0)	34%	18%	84%	92%
Return>5% (N=57)	**BUY-ONLY**	**BUY-and-SELL**	**BUY-and-SELL**	**SELL-ONLY**
Number of stocks	22	26	26	39
%(Trading-Volume)	41%	44%	48%	49%
Mean weighted-return	-5%	-17.5%	21%	32%
Mean %(R>0)	37%	18%	80%	94%

[a] %(Trading-Volume) denotes the proportion of trading in each category (proportions do not sum to 100% because of loans and deposits). Mean weighted-return is the simple average of the volume-weighted average return on the stocks in each list. Mean %(R>0) denotes the average ratio (volume of profitable transactions/total volume of transactions excluding deposits and loans) for the stocks in each category.

The relatively stronger performance of stocks that were only traded in one side of the arbitrage, however, strengthens when the analysis is restricted to the participants with positive eventual returns. The intermediate panel of Table D discloses the results for the 71 subjects with R>0. The volume of trading in stocks that were either sold or purchased but did not attract mixed trading (amongst these 71 participants) is 41%, compared to the 20% proportion for the complete sample. Moreover, the weighted-returns on the stocks that were selected one side only now significantly exceed the weighted-returns on the stocks composing the BUY-and-SELL list (see table).

Finally, at the lowest panel of Table D we run the comparison again restricting the calculations to the 57 participants with arbitrage return larger than 5%. The results here are strongest: the mean weighted-return on the 39 stocks composing the SELL-ONLY list is 32% compared to mean weighted (sell-side) return of 21% on the 26 stocks composing the BUY-and-SELL list ($p<0.02$). The mean weighted-loss on the 22 stocks composing the BUY-ONLY list was -5% compared to mean (buy-side) weighted-loss of -17.5% on the stocks traded on both sides of the arbitrage ($p=0.05$). The large difference between the average SELL-ONLY returns (32%) and BUY-ONLY returns (-5%) suggests, in rough interpretation, that the collective selection patterns of profitable arbitrageurs could prove valuable to outside observers, but the sample size and length of the current experiment are insufficient for testing persistence and specific trailing strategies.

Finally note that similar (slightly weaker) results emerged when transactions were classified as "BUY-ONLY" or "SELL-ONLY" when no opposite transactions were recorded within 3 months from the DATE of delivery. The comparisons for the 57 participants with R>5% for example revealed mean weighted return of 30% in 53 cases where stocks were sold but never purchased within 3 months, compared to mean weighted return of 17% in 12 cases where opposite transactions occurred within 3 months ($p=0.03$). The corresponding long-side results are: -11% average loss in 34 cases where stocks were selected long but never short-sold within 3 months, compared to -15% average loss in 14 cases where mixed-transactions occurred within 90 days (a given stock may classify into both categories when 3-months screening is applied; in fact, none of the stocks appeared in both categories).

Supplement E – Comparison of risk factors long vs. short (section 4)

E.1: Complete version of the upper panel of Table III -including MLP-related factors

	Between-stock comparison			Within-portfolio comparison		
Risk factor	**Long**	**Short**	**P-test**	**Long**	**Short**	**Rank-test**
BETA	1.21	1.34	p<0.01	1.09	1.19	p=0.09
SIZE	5,738	2,572	p<0.01	5,702	3,000	p<0.01
BTM	0.56	0.75	p<0.01	0.57	0.74	p<0.01
MLP	21.7	17.3	p<0.01	22.1	17.9	p<0.05
1[EPS<0]	9.9%	17.1%	p<0.01	10.1%	19.5%	p<0.01

E.2: Measuring risk factors at the level of arbitrage portfolios

To compare risk-taking long vs. short at the level of individual portfolios we calculate a weighted average of the risk factors of stocks purchased and sold. The risk-factors on long-side purchases and short-side sales are weighted by the volume of purchase or sale correspondingly. Deposits and loans are ignored in the calculation of all weighted factors except BETA. In addition we ignore stocks with negative book-equity in the comparison of BTM and stocks with non-positive EPS in the comparison of MLP. The weighting method is illustrated by a hypothetical example: Assume the participant purchased stock X in 600 NIS and deposited the remaining 400 NIS, while selling 600 NIS of stock Y and 400 NIS of stock Z. The 4 leftmost columns of the next table provide the assumed risk factors (at the arbitrage date) for each of the 3 selected stocks. The symbol "—" is used where the risk factor is undefined for the corresponding stock/deposit (e.g., MLP is undefined when EPS≤0).

	Stock-Level Risk				**Weighted Risk**	
	X	**Deposit**	**Y**	**Z**	**Long**	**Short**
Amount invested (sold)	600	400	(600)	(400)	1000	(1000)
BETA	1.5	0	1.5	1.2	0.9	1.38
SIZE	1,000	—	2,000	800	1000	1,520
BTM	0.4	—	0.6	0.8	0.4	0.68
MLP	8	—	9	—	8	9
1[EPS<0]	0	—	0	1	0	0.4
PREV(3MON)	-5%	—	-10%	-20%	-5%	-14%

The weighted BETA long (short) is directly calculated as a volume-weighted average of the betas of stocks purchased or sold assuming BETA=0 for deposits and loans. Weighted BETA long (short) is accordingly equal to 0.6*1.5+0.4*0=0.9 (0.6*1.5+0.4*1.2=1.38). The weighted SIZE factor long is 1,000 – the size of the only stock purchased by the participant. [4] The weighted SIZE short is 0.6*2,000+0.4*800=1,520. The weighted BTM and PREV(3MON) are similarly calculated but the weighting of MLP in short-side transactions ignores stock Z which is assumed to have negative EPS. Weighted MLP long therefore equals 8 (the MLP of stock X) while weighted MLP short equals 9 (the MLP of stock Y). The proportion of negative-EPS stocks in long side transactions is 0 while the proportion of negative EPS stocks in short side transactions is 400/1000=0.4. (The short-side weighted 1[EPS<0] would not change if the participants was borrowing 500 NIS; selling A in 300 NIS and selling B in 200 NIS, since loans and deposits are ignored throughout). The separate consideration of MLP in cases of positive EPS and 1[EPS] in cases where EPS≤0 follows the approach of Fama and French (1992).

[4] Weighting the SIZE of stock X by 0.6 (the proportion of total volume) is misleading. If SIZE is weighted by 0.6 the weighted SIZE factor long would be 600 while other participants that chose to buy the same stock X in 1000 NIS would show weighted SIZE long of 1000. The lower weighted SIZE of the former participant might suggest that risk-taking in terms of SIZE is stronger.

E.3: Robustness of results in Table III (upper panel)

BETA still appears to be more aggressive on the sell-side when measured from the daily return series for 2007, independently of the specific arbitrage date. The mean 2007-BETA of the stocks selected long was 1.14 compared to mean beta of 1.28 for the stocks sold short ($p<0.01$); the weighting of 2007-BETAs at the portfolio level again lessens the differences (mean weighted betas 1.03 vs. 1.12; $p=0.09$). BETA also appears slightly more aggressive on the sell-side when measured contemporaneously along the 3 months arbitrage intervals but the differences diminish: the mean contemporary BETA on stocks selected long was 1.30 compared to mean BETA of 1.39 on stocks sold short ($p=0.11$).[5] The tendency to sell smaller stocks still shows clearly when SIZE is measured from the market values at the end of 2007 (mean SIZE "long" 5,901 vs. mean SIZE "short" 2,741). The uniform measurement of BTM ratios at the end of December 2007 similarly reconfirms the hypothesis that sell-side portfolios are significantly riskier with respect to BTM (mean BTM ratios: 0.47 long vs. 0.59 short; $p<0.01$). Relatively larger BTM ratios on the sell-side alternatively emerge when BTM is measured from the most recent quarterly statements (skipping the 3 months gap): the average buy-side BTM is 0.65 compared to average BTM of 0.87 on the sell-side ($p<0.01$). (BTM ratios increased along 2008 because of the crisis). The tendency to buy stocks with stronger historical performance still shows when one week gap is enforced between the historical measurement and actual arbitrage date. The momentum effect is also established when histories are measured for a backwards-window of 6 months (instead of 3 months) or alternatively measured for the last quarter of 2007, independently of the specific arbitrage date (mean October-December 2007 return on the 294 stocks selected long 4.3% compared to mean return of -0.5% on the 269 stocks sold short; $p<0.01$).

[5] The contemporaneous risk-factors (BETA for the 3 months arbitrage-interval and the BTM ratio from the most recent quarterly statements) were formally unavailable at the date where the arbitrage was submitted but may represent expectations regarding the updated levels of risk.

E.4: Regressions on Net Weighted Risk-Factors

The next 4 models were obtained by regressing the net weighted risk factors (long minus short) on the explanatory variables introduced in supplement C and applying iterated backwards removal.

Model I: Variables that affect net weighted BETA (NW(BETA)) after removal of insignificant coefficients

NW(BETA) = b * LOSS_AVERSE+ c * FAMILIARITY + d* DEPOSIT + e* LOAN

Model II: Variables that affect net weighted SIZE (NW(SIZE)) after removal of insignificant coefficients

NW(SIZE) = b * FAMILIARITY+ c * CONF+ d * MBA + e * LOAN

Model III: Variables that affect net weighted BTM (NW(BTM)) after removal of insignificant coefficients

NW(BTM) = a + b * DATE + c* TA100 + d* RISK_AVERSE

Model IV: Variables that affect (NW(PREV_3MON)) after removal of insignificant coefficients (none of the variables shows significance at 5%)

NW(PREV_3MON) = a

	Model I	Model II	Model III	Model IV
Dependent Variable	**NW(BETA)**	**NW(SIZE)**	**NW(BTM)**	**NW(PREV_3MON)**
Intercept (a)			**1.1**** **(0.3)**	**6.9**** **(2.1)**
LOSS-AVERSE	**0.20**** **(0.05)**	**–**		
RISK-AVERSE	**–**	**–**	-0.21** (0.10	
FAMILIAR	0.04** (0.02)	**-1125**** **(400)**		
LOAN	**0.0013**** **(0.00015)**	**15.6**** **(6.47)**		

DEPOSIT	**-0.0017**** **(0.00019)**	**—**		
CONF		**88.9**** **(29.8)**		
MBA		**4486**** **(1725)**		
TA100			**-0.14**** **(0.05)**	
DATE			**-0.002**** **(0.001)**	
R^2	0.60	0.21	0.15	0.00

Supplement F: GMM estimations (Section 5)

F.1: Example to the calculation of daily risk-premia

Consider the participant that submitted the arbitrage in MAY17.

To calculate the daily market-premia we first sort the stocks in TA220 in ascending order by their BETA for the arbitrage date MAY17.

The ids of the 6 stocks with largest and smallest BETA are disclosed at the next table where we also present the BETA (for MAY17), SIZE (for MAY17; rounded to nearest US$) and daily return in MAY18 for each of the 6 stocks.

Long side of MARKET1- **Buying the 3 stocks with highest MAY17 BETA (among TA220)**				
Stock id	BETA (MAY17)	SIZE (MAY17)	MARKET1	MAY18 return
526012	3.14	113	+45%	-0.0142
434019	2.39	60	+24%	+0.0126
366013	2.34	78	+31%	-0.0168
Short side of MARKET1- **Selling the 3 stocks with lowest MAY17 BETA (among TA220)**				
Stock id	BETA (MAY17)	SIZE (MAY17)	MARKET1	MAY18 return
1082510	0.52	430	11%	-0.0238
1085182	0.52	27	1%	-0.0336
1101534	0.55	3358	88%	+0.00336

The relative SIZE of each stock determined the (fixed) weights of each stock in the MARKET1 arbitrage portfolio (see the column titled MARKET1). The MAY18 return on MARKET1 is then calculated directly as a SIZE-weighted average of the MAY18 returns on the stocks that composed the portfolio:

The weighted return on long-side purchases is:

0.45*(-0.0142%) + 0.24*(0.0126%) + 0.31*(-0.0168%) = -0.086%

The weighted return on short-side sales (return signs are reversed for sell-side transactions) is:

0.11*(0.0238%) + 0.01*(0.0336%) + 0.88*(-0.00336%) = -0.000%

The MAY18 weighted return on MARKET1 is therefore -0.086% (the sum of returns long and short)

The returns for the next trading days (MAY19, MAY20.. etc) are calculated similarly. Weekends and holidays where trade did not take place are ignored. The portfolios MARKET2-MARKET10 are similarly defined from the sorted TA220 list by BETA for MAY17. The (simple) average MAY18 return on the 10 portfolios MARKET1-MARKET10 is used to represent the daily market premia for the corresponding date.

The daily premia for next days are calculated similarly using the same fixed MARKET1-MARKET10 weights. The stocks in each portfolio and the weights however change with the specific DATE where each arbitrage was delivered.

F.2: Correlation in daily risk premia

Table F.2 examines the correlation in daily risk-premia along the experiment. The Pearson coefficients of correlation were separately calculated for each participant from the 55-67 daily observations. The mean, median and standard deviation are presented in the table.

Table F.2: Correlations in daily risk-premia

	SIZE	**BTM**	**MOM**
MARKET	**-0.39 / -0.33**** (0.22)	**0.49 / 0.37**** (0.26)	**-0.31 / -0.30**** (0.46)
SIZE		-0.01 / -0.14 (0.26)	0.11 / 0.23 ** (0.50)
BTM			**-0.23 / -0.26**** (0.24)

F.3 Robustness of GMM estimation results

To discuss robustness we outline 4 main conclusions that emerge from the GMM estimations: (a) portfolios load negatively on BTM and SIZE but loading patterns are mixed for MARKET and MOMENTUM (b) positive average ALPHA; ALPHA>0 for the majority of portfolios (c) positive 0.7 correlation between ALPHA and arbitrage returns (d) positive ALPHAs for confident participants, industry-professionals, and part of the portfolios built on technical methods. In the next paragraphs we briefly argue that these results are robust and reflect in various alternative specifications.

First, we test robustness with respect to the risk premia calculations. When the number of stocks in the risk-riding portfolios (MARKET1-MARKET10, SIZE1-SIZE10 etc) is increased, for instance, from 3 stocks to 6 stocks on each side of the arbitrage, the mean 3-months BTM premia increases to -5.6% (compared to -8% in table IV) reflecting the less extreme position of larger portfolios with respect to BTM risk. The average β_{BTM} in the alternative estimations is -0.20 (compared to -0.11); the coefficient is still negative for 74% of the portfolios. The average ALPHA in the estimations with 6-stock portfolios is smaller 0.013 (compared to 0.03 above) but the median stays robust at 0.02. The average fit of the regressions does not change (mean R^2=0.34) but the left tail of the R2 distribution is longer revealing low fit levels for more portfolios.

Results (a)-(d) also sustain when the number of stocks in the risk-riding portfolios is decreased. When daily risk premia are calculated from 5 portfolios (BETA1-BETA5; SIZE1-SIZE5 etc) instead of 10, β_{BTM} is negative and significant in 40 cases while it is positive and significant for only 21 portfolios. The risk-adjusted ALPHA is positive for 55% of the portfolios; the mean ALPHA for the 28 professionals is 0.07 compared to 0.02 for other participants.

To test if sectoral selection of stocks for purchase and sale captures the loading on MARKET-risk more effectively in the specific conditions of the experiment, we recalculate the MARKET premia assuming that only construction and financial-industry stocks are purchased within the MARKET1-MARKET10 portfolios while "INDUSTRY", "TRADING and SERVICES" and "INVESTMENT" stocks are sold-short (keeping the riskier sectors on the buy-side as in preceding definitions). The modified daily MARKET premia turns out strongly correlated with the preceding

premia measure (mean correlation level 0.96) and the average estimation results are very similar to the results in Table V. The "sectoral" premia however captures the loading styles of several portfolios more effectively and ALPHA appears negative and statistically significant in only 3 cases compared to 8 such cases in table V (see table F.3.1 for details). Opposite patterns emerge when daily risk premia are calculated directly from TA220 (using the daily changes in TA220 to calculate daily market premia, 6 standard SIZE/BTM sorted portfolios to calculate the SIZE and BTM premia and 30% of the TA220 list to calculate momentum returns): although the estimations results are basically similar, the revised premia are less effective in capturing the loading-styles of 47% of the portfolios (in terms of lower R^2) and reveal negative significant ALPHA in 13 cases compared to 8 such cases in table V (see table F.3.2). Results (a)-(d) also reemerged when we iteratively removed the factors that did not show significant effect on portfolio returns (at $p<10\%$). The coefficient β_{BTM} survived the iterated removal in 79 cases; the coefficient was negative in 63% of these cases. The estimations with backward removal moreover revealed positive significant ALPHA for 17 portfolios compared to only 9 cases where the intercept was significantly negative.

The factor model was also run on weekly data (regressing the 13 weekly returns on each portfolios on the corresponding weekly risk-premia) to test the sensitivity of the results to the daily-level estimations. The results of the weekly estimations are somewhat noisier and less informative, possibly because of the small number of 13 observations per portfolio. The participants still appear to load negatively on BTM premia (mean β_{BTM} -0.03; median -0.15; $\beta_{BTM}<0$ for 55% of the portfolios) but the negative loading on SIZE disappears (mean β_{SIZE} 0.02; median 0.01; $\beta_{size}<0$ for only 49% of the portfolios). The mean intercept ALPHA by the weekly regression was 0.14 which appears compatible in magnitude with the 0.03 average ALPHA in the daily regressions, but the median was close to zero. ALPHA was positive and statistically significant for 15% of the portfolios while it was negative and significant in only 8% of the cases. An alternative method to address the high volatility of daily data is to add the one-day lagged premia to the list of explanatory variables in the regressions (as, for example, in Coval et al., 2004). The results of estimations under this approach also appear consistent with conclusions (a)-(d) as outlined above. The intercept ALPHA was positive and 10% significant for 16 portfolios while it was

negative and significant for only 10 portfolios. The correlation between ALPHA and arbitrage returns is almost 0.5; the mean β_{BTM} coefficients are -0.115 (for current premia) and -0.018 (for 1-day lagged premia).

Table F.3.1: Time-series estimation results with sectoral selection of stocks for calculating MARKET premia

In the estimations summarized next, MARKET premia was calculated assuming that only "REAL ESTATE and CONSTRUCTION" or "FINANCIAL SERVICES" stocks are purchased within the MARKET1-MARKET10 portfolios while only INDUSTRY", "TRADING and SERVICES" or "INVESTMENT" stocks are sold within these portfolios. Technically, the list of "REAL ESTATE and CONSTRUCTION" and "FINANCIAL SERVICES" stocks was sorted by BETA and the 3 stocks with highest BETAs were selected for purchase within MARKET1, the next 3 stocks were selected for MARKET2 etc… Similarly, the list of "INDUSTRY", "TRADING and SERVICES" and "INVESTMENT" stocks was sorted by BETA and the 3 stocks with lowest BETAs were selected for sale within MARKET1, the next 3 stocks were selected for sale in MARKET2 etc. The calculation of other premia was not modified. The mean (median) 3-months MARKET premia with the revised definitions are -15.1% (-20.4%) and the correlation with the preceding MARKET premia (the one used for the estimations in Table V) was 0.96. The correlation between ALPHA and arbitrage returns by these estimations is about 0.73

Time-series estimation results with revised MARKET premia (N=130)						
	α	β_M	β_S	β_{BTM}	β_{MOM}	R^2
Mean Median (Standard deviation)	0.03 0.03 (0.47)	-0.05 0.06 (0.70)	-0.07* -0.04 (0.53)	**-0.12**** **-0.10** **(0.67)**	0.04 -0.00 (0.58)	0.34 0.30 (0.22)
Proportion positive	55%	52%	44%	38%	50%	–
Sign-test significance	N.S	N.S	p<0.1	p<0.01	N.S	–
Coefficient positive and 10% -GMM significant	13%	39%	23%	20%	20%	–
Coefficient negative and 10% -GMM significant	2%	37%	22%	27%	23%	–

Table F.3.2:Time-series estimations using Fama and French (1993) 6 portfolios to calculate SIZE and BTM premia and Carhart (1997) 30% criterion to calculate MOMENTUM returns

In the estimations summarized next, daily MARKET premia is calculated by subtracting the daily experimental interest rate from TA200 daily return. To calculate the premia on SIZE and BTM we split TA220 by SIZE and then sort each half by BTM to obtain 6 SIZE/BTM portfolios in the spirit of Fama and French (1993). The daily SIZE and BTM premia are then calculated in the standard manner. Following Carhart (1997) 30% criterion, we subtract the mean return on the 70 stocks (about 30% of TA220) with weakest historical performance in the 90 days preceding the arbitrage from the mean return on the 70 stocks with strongest performance in the 90 days preceding the arbitrage – to obtain the daily MOMENTM premia. The results of the estimations are summarized in the table. The average fit with the revised premia (0.36) is slightly higher than the average fit in the main-text regressions (0.34) but the left tail of the R^2 distribution is longer (e.g., worst decile 0.06 in the current specification compared to 0.08 in the preceding estimations). The correlation between ALPHA and arbitrage return is 0.62.

Time-series estimation results using Fama and French (1993) 6-portfolios to calculate SIZE, and BTM premia and Carhart (1997) 30% criterion to calculate MOM returns from recent 90 days histories (N=130)						
	A	**β_M**	**β_S**	**β_{BTM}**	**β_{MOM}**	**R^2**
Mean Median (Standard deviation)	0.02 0.03 (0.46)	0.01 -0.00 (0.72)	**-0.09*** **-0.15** **(0.69)**	**-0.21**** **-0.14** **(0.94)**	0.04 0.05 (0.53)	0.36 0.32 (0.24)
Proportion positive	53%	49%	40%	43%	55%	—
Sign-test significance	N.S	N.S	p<0.02	p<0.07	N.S	—
Coefficient positive and 10% -GMM significant	12%	28%	14%	19%	29%	—
Coefficient negative and 10% -GMM significant	10%	30%	28%	34%	19%	—

F.4: Factor estimation results for selected portfolios

	return	α	β_{MARKET}	β_{SIZE}	β_{BTM}	β_{MOM}	R^2
Lowest on BTM / MOM (user 674)	+42%	0.9 (1.1)	**-1.3**** **(0.4)**	**0.4**** **(0.1)**	**-2.0**** **(0.7)**	**-2.0**** **(0.7)**	0.28
Lowest on Size (user 369)	-1%	-0.4 (0.6)	-0.5 (0.4)	**-2.0**** **(0.6)**	**1.7**** **(0.7)**	-0.48** (0.26)	0.47
Lowest on MARKET (user 88)	+61%	-1.0 (1.0)	**-1.8**** **(0.3)**	-0.8* (0.6)	-0.7 (0.55)	-0.07 (.4)	0.68
Second Lowest on MOM (user 86)	-43%	-0.2 (0.5)	0.6** (0.3)	**-0.8**** **(0.2)**	0.8** (0.3)	**-1.1**** **(0.4)**	0.75
Highest alpha (user 569)	+64%	1.3** (0.7)	**-1.1**** **(0.3)**	0.7* (0.5)	0.0 (0.4)	0.3 (0.4)	0.76
Lowest alpha (user 445)	-28%	-0.8** (0.45)	0.05 (0.3)	-0.2** (0.7)	**0.95**** **(0.35)**	0.9 (0.7)	0.30

F.5: Regressions on estimated ALPHA

To detect the factors that affect the regression intercept ALPHA we run regressions with model selection testing the explanatory variables that were introduced in supplementary appendix C. The following table presents the final estimation results after removal of insignificant affects. To obtain model I we regressed ALPHA on all the explanatory variables that were introduced in appendix C except for DEPOSIT and LOAN. Only CONF and EDU showed significance. Model II was obtained after including DEPOSIT and LOAN in the list of variables for model selection.

Regressions on loading coefficients did not contribute additional insights, we therefore omit the details.

	Model I	**Model II**
Dependent Variable	ALPHA	ALPHA
CONF	**0.0034**** **(0.0014)**	**0.003**** **(0.001)**
EDU	-0.0088** (0.0052)	–
AGE		-0.004** (0.002)
Deposits		**0.0005**** **(0.0002)**
Loans		-0.0002** (0.0001)
R^2	0.05	0.15

F.6: Factor estimation results by occupation and arbitrage method

Sub-sample	N	Return	α	β_{MARKET}	β_{SIZE}	β_{BTM}	β_{MOM}	R^2
Occupational categories								
Investment Professionals	28	7.2%*	0.07*	0.07	**-0.21****	0.02	0.03	.32
Self-employed	16	8.6%	0.08**	-0.20	-0.11	-0.17**	0.16**	.34
Finance jobs	43	-1.7%	-0.05	-0.11	-0.03	-0.15*	-0.01	.35
Other jobs	42	1.8%	0.07*	0.04	-0.06	-0.14**	0.03	.34
Arbitrage method								
Private info	30	9.7%**	0.01	-0.05	-0.02	**-0.28****	0.13	.28
Other methods	20	3.7%	-0.05	-0.13	**-0.27****	-0.12	0.12	.31
Fundamental	51	-0.3%	-0.02	-0.08	-0.03	-0.12**	0.07	.37
Technical	29	0.1%	**0.19****	0.12	**-0.15****	0.07	**-0.19****	.35
Technicians with payoff>0	14	**22.2%****	**0.52****	-0.03	-0.09	-0.10	-0.05	.34
Technicians with payoff<0	15	-20.5%**	-0.12**	0.25*	-0.20**	0.22*	-0.31**	.36

Discussion of the results for subjects claiming to build the arbitrage by technical considerations: Interestingly, the estimations reveal positive significant intercept for the subjects claiming to build on technical methods. The mean ALPHA for this group (0.19) seems puzzling in light of their relatively weak performance (mean gross return 0.1%). In the 2 bottom lines of the table we separate the technicians with positive returns from those with negative payoffs. Positive ALPHAs (averaging at 0.52%) emerge for the 14 technicians with positive returns that in addition appear to load negatively on MARKET, SIZE and BTM. The results for the 15 technicians with R<0, on the other hand, reveal negative intercept (mean -0.12) and positive loading on MARKET and BTM. The majority of these later participants (11 of 15) were optimistic, expecting the market to rise along their arbitrage.

Translated Script of the Experiment

Page 1

Welcome to the Arbitrage Experiment of the College of Management!

The experiment is run by researchers at the college of management in order to examine various hypotheses regarding the Israeli stock market and aspects of financial decision on stock purchase and sale.

Participation is not restricted in time - you may complete the experiment in your won pace with no disruptions

First, we ask you to fill-in some personal details

Private Name: _____

Family Name: _____

I.D. number: _____

Email:_____

Age: _____

Gender: Male _____/ Female _____

Education:

Years in school (including current academic year): _____

MBA or Student pursuing the MBA degree: Yes / No

Current Profession: (mark the most suitable option)

A. Professional job within the "financial investment" industry (consulting, investment management, brokerage etc)
B. Other professional job related to money management or finance
C. Other occupation. Please explain: _____
D. Unemployed

Experience:

Number of years where you held a professional job within the "financial investment" industry (consulting, investment management, brokerage etc)

Marital Condition:

A. Married with children
B. Married without children
C. Single
D. Other

Net Monthly Income:

A. Less than 4000 NIS
B. Between 4000 NIS and 8000 NIS
C. Between 8000 NIS and 12000 NIS
D. More then 12000 NIS

Please rank in 1-7 scale your theoretical knowledge in finance? (academic courses, financial literature etc)

1 - minimal knowledge
7 - real expert

_____

Please rank in 1-7 scale your familiarity with the Israeli financial market? (Prices, returns. Companies etc)

1 - minimal knowledge
7 – real expert

_____

In my opinion, in the next 3 months the TA100 index would:

A. Rise by 10% or more
B. Rise by more than 5% but less than 10%
C. Rise by less than 5%
D. Decrease by no more than 5%
E. Decrease by more than 5%

Page 2

Arbitrage Transactions: Synopsis

In the experiment you would be requested to buy and sell simultaneously stocks that are traded in the Tel-Aviv stock exchange in total amount of 1000 NIS

Using common professional terminology our main experimental task is an "arbitrage transaction": parallel purchase and sale of securities intended to produce positive return with minimal risk

The purchase of stocks within the arbitrage transaction is standard: The arbitrageur is supposed to buy stocks that should subsequently increase in order to profit from the holding

The sale of stocks within the arbitrage transaction however is a "short sale": The arbitrageur sells stocks that she does not currently hold, intending to cover the short subsequently – by purchasing the stocks that she sold. If possible, the arbitrageur would clearly prefer to short stocks that would decrease subsequently in order to gain the difference between the expensive selling price and the lower buying price.

Here is a simple example to profitable arbitrage: Suppose the investor has purchased in 1.1.2007 some stock A at the amount of 1000 NIS and – in parallel – has sold stock B in similar amount. The investor has closed the arbitrage transaction at 9.30.2007. Assume that the price of stock A has increased to 1200 while the price of stock B has decreased to 950 by this date. The arbitrage in this scenario turned out quite profitable. The investor has purchased a stock that gained 200 NIS while shorting a stock that lost 50 NIS. The total arbitrage gains are therefore 250: the 1200 that the investor collects from selling A minus the 950 paid for purchasing stock B. The cash flow from the arbitrage is summarized in the following table (positive figures refer to revenues from selling stocks while negative figures represent payments for purchasing stocks):

	1/1/2007	9/30/2007
Stock A (purchase)	-1000	+1200
Stock B (short sale)	+1000	-950
Net Revenue	0	+250

Clearly, it is easy to imagine other scenarios where the arbitrage would actually fail. If for instance the price of stock A went down from 1000 to 900 while the price of stock B increased from 1000 to 1150 then the arbitrageur would lose an amount of 250: the 900 NIS that would be received in selling stock A would not cover the amount that should be paid to "cover the short" and purchase stock B (1150). The next table summarizes the outcome of the arbitrage in this alternative scenario:

	1/1/2007	9/30/2007
Stock A (purchase)	-1000	+900
Stock B (short sale)	+1000	-1150
Net Revenue	0	-250

Page 3

The Rational Behind Such Arbitrage Transactions

Comment: This page discussed very briefly some aspects of risk management in arbitrage transactions. In case you are familiar with the topic and short in participation time – you may skip this material and continue to the next page immediately

Arbitrage transactions are especially common today in the hedging-funds industry

Hedging funds enjoy tremendous gains from successful arbitrage:

http://optionarmageddon.blogspot.com/2008/01/other-paulson.html

But also suffer immense losses when their arbitrage gambles fail:

http://www.post-gazette.com/pg/06263/723449-28.stm

What is the rational for such cyclic transactions?

Assuming that the risk level of stocks purchased within the arbitrage is similar to the risk-level of the stocks sold short, the cyclic transactions protects the trader from positive or negative market trends

Assume for example that the arbitrage-trader (ARB henceforth) has purchased stock A while shorting stock B

Assume the two stocks are "similar"; e.g., two moderate size textile-industry stocks (just for illustration)

Obviously, ARB believes that A is traded in more attractive prices than B

Consider the outcome of the arbitrage in two difference scenarios:

Case A:

Suppose the textile index rises along the arbitrage period. ARB's expectations turn true and stock A rises more steeply than stock B. Assume specifically that A gains 300 NIS while B increases by only 100 NIS. In this case, ARB gains 300 on holding A while losing 100 in closing the short-position on B. The net gain from the arbitrage is therefore 200.

Case B:

Suppose alternatively the textile index declines along the arbitrage period. ARB's expectations however regarding the under-pricing of stock A turn true and stock A decreases less steeply than stock B. Assume specifically that A losses 100 NIS while B decreases by 300 NIS. In this case, ARB losses 100 on holding A while gaining 300 when closing the short-position on B. The net gain from the arbitrage is therefore 200.

We have demonstrated that the purchase and sale of similar stocks (e.g., similar stocks from the same industry) protects the trader from industry specific trends; the trader enjoys the profit from buying the better stock while selling the worse stock – independently of specific market conditions!

When the stocks purchased in the arbitrage are riskier or less risky than the stocks sold, it is possible to adjust risk levels by investing funds in deposits or borrowing funds in risk-free interest. If stock A for instance is more risky than stock B, we may sell 1000 NIS of stock B, purchase A at the amount of 600 and invest the remaining 400 in risk-free deposit, to "adjust risk levels".

Interested in more details? See the discussion in William Goetzmann Internet chapter: http://viking.som.yale.edu/will/finman540/classnotes/class6.html

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Page 4

Outline of the Experiment

{We omit the paragraphs dealing with the long-run arbitrage which will be discussed in a subsequent paper}

In the experiment, you will be asked to submit 2 arbitrage portfolios on leading stocks from the Israeli market

The first arbitrage portfolio is for 3 months. That is, the arbitrage "positions" that you would submit along the experiment would be closed after 3 months (approximately) to calculate the gains or losses from the arbitrage. Clearly, in this case you would prefer to purchase stocks that seem as a relatively attractive investment for the next quarter while shorting stocks that seem less attractive for such short-run investment.

The experiment organizers would calculate the gains/losses from the arbitrage (as illustrated above) and the results would be reported at the of arbitrage period. The experimental process would therefore end in more than one year from today. Still, the results for the short-run arbitrage for 3 months would be reported about 3 months after closing the experiment.

The reports that would be distributed at the end of each phase would let you compare your won payoff with the payoff of all other participants. Participants would be only identified by id numbers to preserve anonymity.

In addition, we would pay to 100 of the participants in the experiment "real" monetary prizes. The identity of real-prize winners would be randomly determined using random number generation. The payoff, in check, would be sent to the address that you would provide in the last page of the experiment. The actual payment would increase with the gains from the arbitrage. Participants that ended-up with larger arbitrage gains (or smaller losses) would receive larger payments than participants with weaker results. The id numbers of the participants that were selected for real-payment and the amount paid to each of these participants would be disclosed by email at the end of the corresponding phase of the experiment. More details regarding the payment method would be disclosed in subsequent pages.

Please note that we guarantee your anonymity! Your private name, family name or other identifying details (except your id number) would not be published in the emails that we distribute or any other public reports regarding the experiment.

The fairness of the experimental procedure and the payment method is guaranteed!

Upon request, we will let subjects examine the complete result files at the end of the experiment – to let you control the process. The experiment is run for academic research. We ask for your serious candid cooperation!

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More Details on the Experimental Arbitrage

The next table presents the specific format that would be used to collect your arbitrage portfolios:

Stock Purchase			**Stock Sale**	
Stock Name	Amount Purchased		Stock Name	Amount Sold
Total	**1000**		**Total**	**1000**

* You may choose stocks from the TA100 list (the 100 largest stocks in the market) or the TA YETER120 list (the next 120 largest stocks in the market). **The list of 220 available stocks** would be presented – together with links to updated information regarding these stocks – in the page where you would be asked to deliver your arbitrage.

* In addition to selecting stocks from the list, you would be permitted to deposit funds or borrow funds in fixed 3-months interest rate of 2%. In case you decide to deposit funds in such risk-free interest for 3-months, write "DEPOSIT" instead of providing a specific stock name in the stock purchase column. In case you decide to borrow funds in the risk-free interest-rate, write "LOAN" in the stock sale column.

* The number of stocks that may be purchased in the arbitrage and the number of stocks that may be sold in the arbitrage is limited to 3. The arbitrage table therefore includes only 3 lines in each panel. Deposits and loans however are considered stock purchase and sale correspondingly. The maximal number of stocks purchased (or

sold) therefore decreases to 2 in case you decide to deposit (or borrow) funds in risk-free interest.

* The next page provides some arbitrary example to the type of arbitrage portfolios that may be submitted:

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Examples

This page presents 3 examples to possible arbitrage transactions. The stocks for each transaction were selected in alphabetic order from the list of stocks traded in the Tel-Aviv exchange.

Example 1:

Stock Purchase			**Stock Sale**	
Stock Name	Amount Purchased		Stock Name	Amount Sold
AAORA	**1000**		**ABGOL**	**1000**
Total	**1000**		**Total**	**1000**

The investor in example 1 believes that AAORA is traded in attractive prices while ABGOL is overpriced (we ignore the risk aspects for these technical examples). The investor therefore constructs a simple arbitrage portfolio with only one stock in each side of the table. Similarly, it is possible to construct other portfolios where the investor buys 1-3 stocks from the list and sells 1-3 stocks from the list – with no investing in deposit or borrowing by loans. The number of stocks purchased in the arbitrage may be different from the number of stocks sold. You are permitted, for example, to buy 1 stock while selling 3 stocks etc..

Example 2:

Stock Purchase			Stock Sale	
Stock Name	Amount Purchased		Stock Name	Amount Sold
AVNER Y	**600**		**LOAN**	**1000**
IGOD	**400**			
Total	**1000**		**Total**	**1000**

In example 2, the investor believes that AVNER Y and IGOD are attractive for purchase but she hesitates on choosing stocks suitable for sale. She therefore chooses to borrow the arbitrage funds (1000 NIS) in risk-free interest rate instead of selling stocks short. If the investment in AVNER Y and IGOD indeed turn profitable we would subtract the interest on the loan of 1000 (2%) to calculate the final gain from the arbitrage.

Example 3:

Stock Purchase			Stock Sale	
Stock Name	Amount Purchased		Stock Name	Amount Sold
AGARI	**500**		**ELDAR**	**100**
EDGAR	**200**		**O.R.T**	**400**
DEPOSIT	**300**		**AUDIOCODES**	**500**
Total	**1000**		**Total**	**1000**

In example 3, the investor believes that ELDAR, O.R.T, and AUDIOCODES are relatively "weak" stocks compared to AGARI and EDGAR and therefore sells the first 3 stocks while the buying the last 2 stocks in the proportions provided in the table. The investor also chooses to invest 300 NIS in risk-free interest to decrease the risk on long-side transactions.

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More Details on the Experimental Method

In reality, arbitrage transactions are clearly more complicated. The purchase of given stocks and short sale of other stocks might affect market prices and transaction costs arise and may turn the gain from skillful selection of stocks long and short into net losses. To import this complexity into the experiment we take the following measures:

1. The buying or selling price of the stocks that you selected would be determined by the market price 1-5 days after the date where your arbitrage transactions was delivered. The exact date would be randomly determined by the program of the experiment. For example, if your portfolio was sent in 4/4/2008 then your buying and selling prices would be randomly selected for one of the days between 4/5/2008 and 4/9/2008.

2. The exact arbitrage period would also be randomly determined. The arbitrage positions (long and short) would be closed after 87-93 days – where the exact length would be randomly determined for each participant

3. An amount of 20 NIS would be subtracted from your arbitrage gain (or added to your arbitrage loss) to represent transaction costs and fees

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Actual Payment Method

At the end of the experiment we would randomly select 100 participants (henceforth: "the selected winners") that would receive an actual payment depending on the results of their arbitrage.

Each selected winner would be randomly assigned to one of the 2 major experimental tasks: the 3 months arbitrage or the long-run arbitrage (henceforth: "the selected task")

The payment to "selected winners" would depend on the result of the selected task. The actual payment may even exceed 200 NIS!

The complete list of participants marking the 100 "selected winners" and the type of "selected task" for each selected winner would be distributed by email at the end of the experiment – to let you control the experimental process!

The selected winners would be identified by their id numbers to preserve anonymity

The exact payment method is disclosed in the box below:

If the selected task is the 3 months arbitrage then we multiply the gain or loss from the arbitrage by 4 (to annualize the payoffs) and add or subtract the product from an initial balance of 200 NIS. Your actual payout would be equal to 0.5 of the resulting balance. For example, if your arbitrage has produced a gain of 21 NIS, your final balance is 284 (200+21*4) so your check would be 142 NIS. If, on the other hand, your arbitrage was closed in a loss of 15 NIS, then your final balance is 200-4*15=140, so your payoff for participation would be 70 NIS

Questions to the experiment-organizers?

Don't hesitate. Email NISSOY@GMAIL.COM

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Final Remarks Before Experimental Assignments

*You may retrieve detailed information on each of the stocks in the following sites:

The Tel-Aviv Stock Exchange

(link to http://www.tase.co.il/TASE/MarketData/Stocks/MarketData/)

Bizportal

(link to http://www.bizportal.co.il/shukhahon/sh_rezef.shtml)

The Marker

(link to http://finance.themarker.com/)

*The links to the 3 databases would be also available at the main page where you submit the arbitrage portfolio

* The experimental results (anonymous; identifying subjects only through their social security numbers) would be distributed by email at the end of each phase. The 3 months arbitrage results would be distributed approximately 3 months after we close the experiment for further participation. The email would provide details on the specific arbitrage selected by each participant; the gain or loss from the selected arbitrage portfolio and the actual payment to "selected winners".

* We can now proceed to the experiment itself!. The experiment consists of 4 pages. The 2 first pages are introductory task where we first attempt to characterize your level of familiarity with the Israeli market and then try to characterize your risk preferences. The final 2 pages ask you to submit your arbitrage portfolios.

*Good luck!

Task 1: Familiarity Quiz

This page presents 3 multiple-choice problems regarding the performance of the Israeli stock market over the last calendar year

In each problem, please mark the option that seems most appropriate

You have 3 minutes to complete the assignment.

The program would automatically proceed to the next phase after 180 seconds.

{The 3 problems were randomly selected by the experiment program for each participant. Each problem was randomly selected from a pool of 25 problems of similar level of difficulty; the first problem was meant to be easiest and the last one most difficult. We present one of the problems in the easiest category for illustration:

Which of the following indices earned the lowest return in 2007?

1. TA DIV20
2. TA TECH 15
3. TA100
4. TA25

Task 2: Personal Risk Preferences

In this page we ask you to mark your choices (A or B) in 6 distinct binary choice problems

In each problem, option A represents a binary lottery – paying 2 distinct prizes with equal chances 50% for each prize. In some cases, one of the prizes is negative so the lottery may result in a loss rather than paying a positive prize. Option B, on the other hand, always represents a given (certain) amount. We ask you to choose between option A (the lottery) and option B (the certain amount), in each of the 6 problems.

Please submit your candid choices!

Clearly, the choice between lotteries and risk-less prizes depends on the personal tastes of the decision-maker and does not admit a unique solution.

Actual Payment: At the end of the experiment we will randomly select 6 participants – one participant for each of the 6 problems and pay each of these participants a cash prize according to the choices he made in the corresponding problem. More details on the exact payment method can be found in the next link

Link for more explanations the payment method

Your actual payment would be derived from your choice between options A and B. If you selected option A, we would randomly draw the outcome of the lottery and pay you the corresponding outcome + 60 NIS. If you selected option B, your payoff would be equal to the amount stipulated in option B + 60 NIS. Consider for instance the first choice problem 1. If you have selected option A and the outcome of the lottery (which would be randomly determined by the computer) would be 200, then you would receive 260 NIS. If on the other hand, the outcome of the lottery would be 50, then your check will be for 110 NIS. If however you selected option B, your payment would be 215 NIS. Please note again that only 6 participants (one participant for each problem) – would actually be paid for the choice assignments.

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Choice Problem 1:

●Option A1: (9%)

Probability	NIS
50%	200
50%	50

●Option B1: (91%)

Probability	NIS
100%	165

Choice Problem 2:

●Option A2: (30%)

Probability	NIS
50%	200
50%	50

●Option B2: (70%)

Probability	NIS
100%	125

Choice Problem 3:

●Option 3A: (93%)

Probability	NIS
50%	200
50%	50

●Option 3B: (7%)

Probability	NIS
100%	85

Choice Problem 4:

●Option A4: (12%)

Probability	NIS
50%	200
50%	-50

●Option B4: (78%)

Probability	NIS
100%	105

Choice Problem 5:

●Option A5: (37.5%)

Probability	NIS
50%	200

50%	-50

- Option B5: (62.5%)

Probability	NIS
100%	75

Choice Problem 6:

- Option A6: (90%)

Probability	NIS
50%	200
50%	-50

- Option B6: (10%)

Probability	NIS
100%	45

Task 3: Three months Arbitrage

You may now select the arbitrage portfolio for 3 months:

The following databases may help your decision:

The Tel-Aviv Stock Exchange

(link to http://www.tase.co.il/TASE/MarketData/Stocks/MarketData/)

Bizportal

(link to http://www.bizportal.co.il/shukhahon/sh_rezef.shtml)

The Marker

(link to http://finance.themarker.com/)

*To reexamine the list of 220 stocks that can be selected for the arbitrage click here:

List of Available Stocks

* Please recall that you may also deposit amounts in risk-free interest rate of 2% for the next 3 months. To invest funds in risk-free interest select "DEPOSIT" in the "Stock Purchase" panel in the table below. Alternatively, you may borrow funds at the risk-free interest rate of 2%. To borrow funds please select "LOAN" in the "Stock Sell" panel in the table below.

* Please submit you transaction through the following table as demonstrated in preceding examples

To Reexamine the Examples Click Here

Stock Purchase			**Stock Sale**	
Stock Name	Amount Purchased		Stock Name	Amount Sold
Total	**1000**		**Total**	**1000**

*please recall that you may logoff the experiment and reenter later successively with no limitations

* Questions to the experiment organizers?

Email NISSOY@GMAIL.COM and we'll get back to you asap.

Final Page

Thanks you for taking part in the arbitrage experiment of the college of Management!

Few final questions to conclude the experiment:

*Could you specify the criteria that you have used to select stocks for the 3-months arbitrage? (mark the most appropriate box)

_____ Fundamental (economic) analysis

_____ Technical analysis

_____ Private information

_____ others?

Please explain _____

*Please estimate the chances that the arbitrage portfolio that you have constructed would generate positive payoff:

The chances – in my opinion – that the 3 months arbitrage would earn positive return are _____%

*Please provide us a valid address for the next 14 months – for distributing the cash prizes

Name:_____

Street and number:_____

City:_____

Zip code:_____

*Please write down our email address for future inquires:

NISSOY@GMAIL.COM

Thanks again for your cooperation!