

Game Theory and Behavioral Finance

Gregory LaBlanc September 11th, 2014



Revolutionizing Global Leadership



Bubbles





Tulipmania



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South Sea Bubble





Japanese Real Estate

- 1991, land value in Japan nearly \$20 trillion.
 - Over 20% of world's wealth
 - Double world's equity markets
- Land under Emperor's Palace (3/4 sq mi) estimated to be worth same as all land in California or in Canada



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erkelev

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Source: "Urban Land Price Index and National Wooden House Market Value Index as of the End March 2004," Japan Real Estate Institute, May 2004.



VA Linux

- Dec 1999
 - IPO open @ \$30; traded as high \$320; closed \$239
 - 179 employees
 - \$9.5 billion market cap (~53 million per employee)















Change in split-adjusted share price









Housing in the 2000s





Housing in the 2000s







Chart created at www.stockcharts.com





Zynga





Experimental Economics



eXperimentalsocial science**laboratory**





Overview of the Experimental Environment

- Caginalp, Porter, and Smith (2001)
- Features of the Experimental setup
 - 15 period asset
 - Dividend uncertainty
 - {0,8,28,60}
 - Initial cash and shares
 - Double auction or call market trading mechanism
 - Experiment is repeated with same traders



Fundamental Value Line



The Computer Interface





Inexperienced Traders' Time Series



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Experience





Game Theory

- Simple games involve
 - Two players
 - Two "strategies"
- Create a two by two payoff matrix
- Classic games
 - Prisoners Dilemma (public goods) game
 - Stag and Hare (assurance, pure cooperation)game
 - Hawk and Dove (conflict) game



Hunting Stag





Hunting Hare





Stag and Hare



Stag and Hare





Standard Wars



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Path Dependence



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27



Hawk or Dove?







If V<W, which is best?

	Hawk	Dove
Hawk	1⁄2 (V-W)	0
	½ (V-W)	V
Dove	V	1⁄2 V
	0	1/2 V



If V<W



Frequency Dependent Strategies





MixedStrategies



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Randomizer



Random Number Generator - Professional Edition	
File Edit Analysis Help	
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Enter lower bound random number (inclusive):	n l Dist Asia
Enter upper bound random number (inclusive): 100000	<u>Start Again</u>
How many random numbers would you like to generate? 15000 Must be less than 32,767	o <u>N</u> otepad E <u>x</u> it
Do you want unique numbers from within this range? $ec{arphi}$ Ticked means "yes"	
Will you be wanting to generate all possible values from within this range? For example, if you chose 1 as the lower bound number and 10 as the upper bound number, tick this 🧮 Ti box if you want 10 numbers to appear (i.e., all numbers in a random sequence).	icked means "yes"
29833, 75511, 91448, 28468, 31660, 73080, 14586, 36522, 102, 14947, 72407, 37790, 97102, 71542, 97202, 29664, 72702, 16067, 87285, 13446, 84273, 17610, 98891, 54919, 55970, 3916 2039, 9639, 8477, 81106, 75077, 1337, 66730, 31465, 72989, 85458, 5859, 64986, 45361, 74 18963, 87812, 21713, 17417, 81837, 2731, 91338, 90404, 42296, 8098, 40008, 75082, 21195, 84537, 16403, 78757, 61587, 72174, 56334, 71838, 63325, 43015, 5245, 15405, 92122, 9132, 66892, 48550, 72226, 80198, 13039, 62995, 11435, 39938, 26714, 68282, 21636, 9419, 34573, 74517, 17195, 95431, 60668, 8872, 1265, 6818, 60711, 37737, 57238, 60339, 82231, 65452, 42114, 27410, 44515, 17976, 92019, 80358, 2689, 17404 61531, 47065, 26836, 22160, 1025, 63668, 96776, 78087, 61001, 25461, 11226, 60250, 62977, 12862, 13316, 7502, 5523, 70221, 13404, 83346, 25791, 89344, 44528, 46506, 14426, 67167, 14234, 9378, 91123, 38083, 33353, 52894, 29656, 44422, 85789, 42225, 38877, 4207, 6624, 719979, 83270, 6576, 30870, 38102, 87811, 43221, 7135, 93708, 92755, 37861, 13430, 93174, 45794, 44025, 86146, 45791, 41825, 50025, 80111, 14251, 43248, 95554, 416251, 1226, 26376, 34208, 75525, 307827, 13404, 9378, 91123, 93038, 32933, 52894, 2965, 44422, 85789, 42225, 38877, 4207, 6624, 719979, 83270, 6576, 50870, 03102, 87811, 43221, 7135, 93708, 92755, 37861, 13430, 93174, 45794, 44025, 86146, 45791, 41825, 50025, 80111, 4321, 7135, 93708, 93735, 33051, 29284, 45559, 30572, 50359, 80130, 9158, 53728, 1415, 52220, 36957, 31773, 52075, 55736, 27042, 75855, 82794, 2210, 92102, 71760, 3530, 39733, 5337, 79638, 610015, 36538, 16142, 93559, 31372, 51496, 59183, 25693, 76206, 18288, 79927, 25104, 1803	46529, 34913, 3520, 65172, 65, 49289, 83535, 55634, 8278, 4713, 49976, 57983, 69324, 97596, 17925, 27098, 32848, 10367, 68618, 51744, 97478, 76, 52088, 1041, 50465, 7095, 31131, 92325, 85129, 96310, 4, 96886, 61308, 78182, 80889, 7, 99149, 76320, 31494, 74658, 5177, 64193, 26755, 67997, 72901, 47234, 23495, 40679, 10340, 62400, 39296, 78132, 0, 76653, 88119, 76817, 94684, 7, 15039, 52660, 17941, 6417, 7, 66631, 32587, 92266, 84878, 62154, 42108, 88471, 84459, 35, 97611, 52528, 589, 36722,
The Random Number Generator - www.ClinTools.com 11/08/2006	3:54 AM //





The Review of Economic Studies, Ltd.

Professionals Play Minimax Author(s): Ignacio Palacios-Huerta Reviewed work(s): Source: *The Review of Economic Studies*, Vol. 70, No. 2 (Apr., 2003), pp. 395-415 Published by: <u>Oxford University Press</u> Stable URL: http://www.jstor.org/stable/3648639



$$\begin{array}{cccc} g_L & 1 - g_L \\ k_L & 58.30 & 94.97 \\ 1 - k_L & 92.91 & 69.92 \end{array}$$

	g _L (%)	$1 - g_L(\%)$	k_L (%)	$1 - k_L (\%)$
Nash predicted frequencies	41.99	58.01	38.54	61.46
Actual frequencies	42.31	57.69	39.98	60.02



NBER WORKING PAPER SERIES

PROFESSIONALS DO NOT PLAY MINIMAX: EVIDENCE FROM MAJOR LEAGUE BASEBALL AND THE NATIONAL FOOTBALL LEAGUE

Kenneth Kovash Steven D. Levitt

Working Paper 15347 http://www.nber.org/papers/w15347



Too many fastballs



Table 1: Major League Baseball Summary Statistics by Pitch Type

	-	Distribution of Outcomes				Per	cent Throw	vn In	
Pitch Type	Number of observations	Ball	Strike/ foul	In Play Out	In Play Hit	OPS if AB Ends on this Pitch	Hitter's Counts	Neutral Counts	Pitcher's Counts
Fastball	2000619	36.41%	43.37%	13.43%	6.79%	0.753	75.33%	66.49%	55.52%
All Non-Fastball	1109810	38.07%	42.60%	13.09%	6.24%	0.620	24.67%	33.51%	44.48%
Change-Up	391318	37.12%	40.51%	15.29%	7.08%	0.658	11.52%	11.84%	14.16%
Slider	421031	37.81%	44.22%	12.14%	5.83%	0.598	8.76%	12.58%	17.38%
Curveball	297461	39.68%	43.07%	11.54%	5.70%	0.594	4.40%	9.10%	12.94%

Notes: Data cover pitches from 2002-2006. Pitch types based on classifications by the data provider, Baseball Info Solutions, with some aggregation of categories by the authors. Columns 2-5 report the outcome on the pitch in question. OPS refers to the statistic on-base percentage plus slugging percentage. Hitter's counts are defined as 1-0, 2-0, 3-0, and 3-1 counts; neutral counts are 0-0, 1-1, 2-1, and 3-2 counts, pitcher's counts are 0-1, 0-2, 1-2, and 2-2 counts. See the text for details on sample exclusions.

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Too much alternating!

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Fastball	Curveball	Changeup	Slider	Fastball	Curveball	Changeup	Slider
Previous Fastball	-0.041***				-0.033***	0.016***	0.021***	0.015***
	(0.001)				(0.002)	(0.001)	(0.001)	(0.001)
Previous Curveball		-0.009***			0.014***	0.005***		0.000
		(0.001)			(0.002)	(0.001)		(0.002)
Previous Changeup			0.001				0.019***	
			(0.001)				(0.002)	
Previous Slider				-0.023***	0.013***	0.006***	0.011***	-0.010***
				(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Observations	2276074	2276074	2276074	2276074	2276074	2276074	2276074	2276074
R ²	0.194	0.241	0.198	0.242	0.194	0.241	0.198	0.242

Table 5: Serial Correlation in Pitch Type

Notes: Dependent variable is an indicator variable equal to one if the pitch thrown is named at the top of the column, and zero otherwise. In all cases the values reported in the table are the coefficient on an indicator variable corresponding to whether the previous pitch in the at-bat was the pitch type named in the rightmost column. Each column represents a different regression. Columns (1)-(4) include pitch-types one at a time; columns (5)-(8) include all pitch-types simultaneously. All specifications include interactions for pitcher*batter*count*number of pitches of each pitch type thrown thus far in the at-bat, so identification comes only from cases where the same pitcher and batter have reached the same count with the same distribution of pitch types, but in differing orders of pitch types thrown. Standard errors are shown in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001

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Not enough passing

	All plays	Runs only	Passes only	P-value of runs
				versus passes
Success Metric	0.000	-0.0370	0.0292	0.000
	(1.233)	(0.903)	(1.441)	
Yards Gained	4.367	4.052	4.615	0.000
	(11.51)	(7.636)	(13.82)	
First Down Made	0.265	0.210	0.308	0.000
	(0.441)	(0.407)	(0.462)	
Fumble or Interception	0.0336	0.0150	0.0482	0.000
-	(0.180)	(0.122)	(0.214)	
Scoring Play	0.0338	0.0284	0.0382	0.000
5 7	(0.181)	(0.166)	(0.192)	
Far from Goal	0.354	0.345	0.361	0.000
	(0.478)	(0.475)	(0.480)	
Medium from Goal	0.379	0.361	0.394	0.000
	(0.485)	(0.480)	(0.489)	
Close to Goal	0.267	0.294	0.245	0.000
	(0.442)	(0.456)	(0.430)	
2001	0.194	0.191	0.197	0.006
	(0.396)	(0.393)	(0.398)	
2002	0.205*	0.198	0.211	0.000
	(0.404)	(0.398)	(0.408)	
2003	0.202	0.207*	0.199	0.000
	(0.402)	(0.405)	(0.399)	
2004	0.203	0.207	0.200	0.004
	(0.402)	(0.405)	(0.400)	
2005	0.195	0.197	0.193	0.068
	(0.396)	(0.398)	(0.395)	
Temperature 40 or Below	0.120	0.124	0.116	0.000
	(0.325)	(0.330)	(0.320)	
Home Team	0.505	0.515	0.498	0.000
	(0.500)	(0.500)	(0.500)	
Grass	0.638	0.639	0.638	0.609
	(0.480)	(0.480)	(0.481)	
Number of observations	127885	56401	71484	

Table 6: Summary Statistics for NFL Football



Notes: The unit of observation is an offensive play. Data includes plays from 2001-2005 for the National Football League, excluding fourth-down plays, plays in the last two minutes of a half, overtime, and quarterback runs (which we cannot accurately categorize in terms of intentions into runs versus passes). The variable "success metric" is our estimate of a given play's contribution to the offensive team's score relative to the average play from this down, distance, and yards to goal. The final column of the table reports p-values from a t-test of equality of means for running and passing plays. Standard deviations are shown in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001



Too much alternating

Table 9: Serial Correlation in NFL Play Calling as a Function of Previous Play Success

	All	No	Neutral	Yes
Previous Play Was a Pass	-0.100***	-0.145***	-0.096***	-0.025***
Season Passing Percentage	(0.003) 0.710***	(0.005) 0.562***	(0.006) 0.780	(0.006) 0.763***
Game Passing Percentage	(0.032) 0.078***	(0.049) 0.080***	(0.057) 0.092***	(0.059) 0.056**
Season Passing Percentage Against	(0.010) 0.367***	(0.016) 0.291***	(0.018) 0.363***	(0.019) 0.414
	(0.039)	(0.061)	(0.069)	(0.072)
Observations	102220	34075	34076	34069
R ²	0.217	0.194	0.178	0.114

Notes: The dependent variable is an indicator for whether this play is a pass. The first play of a drive and any play for which it is unclear whether the previous play was intended to be a run or a pass are excluded from the regression. Controls included in the regression, but not shown in the table, include interactions for down*distance, quarter*score differential, and indicators for grass versus turf, temperature below 40 degrees, and home team. The first column includes all other plays; the remaining three columns divides the sample into thirds based on the how successful the preceding play according to our success metric. Standard errors are shown in parentheses. * p < 0.05, **p < 0.01



Which Route to take?



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42

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Predator Prey



Passive

VS

Active





Add index investments to your portfolio

 Use index funds to secure your retirement

Understand returns and risk

 Apply winning strategies for long-term investing

Russell Wild, MBA Author, Exchange-Traded Funds For Dummies and Bond Investing For Dummies







Know your ecology





Agent Based Modeling







Yahoo News Error





47

Instructions

Please write down a number between 0 and 100 (inclusive) such that your guess will be as close as possible to 2/3 of the average guess.

Put your name on your card Winner gets \$20



"Beauty Contest"



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Beauty Contest

Table 1: Data and	estimates of	τ in pbc gar	nes	
(equilibrium = 0)				
	Mean	Steps of		
subjects/game	Data	Thinking		
game theorists	19.1	3.7		
Caltech	23.0	3.0		
newspaper	23.0	3.0		
portfolio mgrs	24.3	2.8		
econ PhD class	27.4	2.3		
high school	32.5	1.6		
70 yr olds	37.0	1.1		
Germany	37.2	1.1		
CEOs	37.9	1.0		
	Mean	2.18		
	Median	2.30		
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			50	JC Berkeley
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Hedge Funds & the Bubble



Hedge Fund Portfolio ----- Market Portfolio

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Clash of the Titans







Noise Trader Risk



Trend Chasing



Source: Strategic Insight and Morningstar as of December 31, 2010. Stock funds are represented by domestic equity funds. Past performance is not a guarantee of future results.

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Hedge Funds

Table 2: Statistics for hedge funds and main asset classes

Hzdge Funds **Global Stools Global Bonds** Commodities Mean 9.07718 6.25727Std. 720 15.72 3.95 22.47Sharpe. 0.760.230.680.16Value-at-Risk at 5 % 2.6910.71 1.19 8.42 Panel B: Correlations between hedge funds and main asset classes B1:All observations

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Panol A: Doscript	ivo statistics in	or hedge tunds	and main	asset classes

	Hedge Funds	Global Stocks	Global Bonds	Commodities
Hedge Funds	1.00			
Global Stocks	0.80	1.00		
Global Bonds	-0.06	-0.03	1.00	
Commodities	0.41	0.33	0.00	1.00



Hedge Funds





Emotions





Financial Advisors





When does it pay to stick with the herd?





And when does it not?



"I'm just curious—what's your excuse?"

