Internet Appendix to
Portfolio Choice: Familiarity, Hedging, and Industry Bias

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I. Pooled Tobit regressions

The most appropriate option for modeling the economic relations between our dependent and explanatory variables in Tables 4, 5, and 6, is a panel Tobit with random effects. Because our models do not allow for clustering of standard errors we include in this section alternative versions of these tables which utilize a pooled Tobit model with clustered standard errors. Results in Tables IA2 and IA3 indicate that the models estimated in Tables 5 and 6 are statistically robust to a pooled model with clustered standard errors.[1] In Table IA1 we find that our variable of interest, underwriting risk (*UND_RISK*), is not robust to a pooled model with standard errors. However, this is not due to clustered standard errors. The coefficients produced by a pooled Tobit without clustered standard errors are not statistically significant and, unlike in the random effects model, are not negative. As a likelihood-ratio test suggests that a pooled specification is inferior to a panel with random effects, we do not believe these pooled results weaken the implication of Table 4. Overall, considering both our original and alternate analyses, we still find substantial evidence that PL insurers factor hedging non-financial income risk into their portfolio allocation decisions.

II. Behavioral bias

Our analyses in the manuscript suggest that PL insurers' industry bias is heavily influenced by their hedging incentives and their preference for familiar stocks is driven by an information advantage in their own industry. Overall, these deviations from the market portfolio appear rational in nature. Our analysis in this section of the internet appendix examines whether this rationality

[1] As our sample has a wide cross section (1,407 of firms) and a short time series (15 years of annual data), clustering across both dimensions could artificially inflate standard errors (Thompson (2011)). In accordance with Thompson (2011) we choose the smaller of the two dimensions, and cluster by years in Tables IA1, IA2, and IA3.

extends to another well documented behavioral bias in equity portfolio managers, the disposition effect (Shefrin and Statman (1985)).

The disposition effect refers to the tendency of investors to sell winning investments too soon and hold losing investments too long (see e.g. Dhar and Zhu (2006), Frazzini (2006), and Cici (2012). It is a classic behavioral bias often found in individual investors and can be explained by prospect theory (people are risk-averse over gains but risk-seeking over losses) and an irrational belief in mean reversion (Odean (1998)). To test the disposition effect, we follow Odean (1998) and go through each insurer's trading records in chronological order to compare their proportion of gains realized and proportion of losses realized. Given the granularity of required disclosure by insurers (i.e. transaction level reporting) insurance equity portfolios are also an ideal, precise setting for examining the disposition effect.

For each insurer, we construct for each date a portfolio of stocks with the purchase dates and prices. On each day when a sale takes place in a portfolio of two or more stocks, we compare the selling price for each stock sold to its average purchase price to identify whether that stock is sold for a gain or loss. For each stock that is not sold but in the portfolio at the beginning of that day, we determine whether it is a paper gain or loss by comparing its high and low price for that day (obtained from CRSP) to its average purchase price. A stock is counted as a paper gain (loss) if both its daily high and low are above (below) its average purchase price, and neither a paper gain or loss is counted if its average purchase price lies between the high and low price. All gains and losses are calculated after adjustment for stock splits. No gains or losses (regardless of whether realized or paper) are counted on days when no sales take place in an insurer's portfolio.

The realized gains, paper gains, realized losses, and paper losses are aggregated for each insurer and then across all insurers. The proportion of gains realized (*PGR*) and the proportion of losses realized (*PLR*) are defined as follows,

(1) $$PGR = \frac{Realized\ Gains}{Realized\ Gains + Paper\ Gains}$$

(2) $$PLR = \frac{Realized\ Losses}{Realized\ Losses + Paper\ Losses}$$

If investors tend to sell their winning stocks and hold their losing stocks (disposition effect), then *PGR* is expected to be greater than *PLR*.

Column (1) in Table IA4 reports the *PGR* and the *PLR* for the entire year. We find that *PLR* is greater than *PGR* in PL insurers' stock transactions and that the *t*-statistic is 48.69, which can reject the null hypothesis that *PGR* ≥ *PLR* in a one-tail test.[2] Thus, we do not find evidence for the disposition effect. Odean (1998) contends that for tax purposes, investors tend to sell their losing stocks and realize their losses in December (which is known as tax-loss selling), as the end of year is the deadline for realizing those losses. Thus, he postulates that investors are more willing to sell losing stocks and less willing to sell winning stocks, exhibiting lower disposition effect. He finds that the disposition effect is indeed restricted to January to November and that no disposition effect is shown in December. To determine if our results for the entire year are simply driven by

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[2] The *t*-statistic tests the null hypothesis that the difference in proportions is equal to 0 assuming that all realized gains, paper gains, realized losses, and paper losses result from independent decisions. Following Odean (1998), we calculate the standard error for the *t*-statistics as:

$$Standard\ Error = \sqrt{\frac{PGR(1-PGR)}{n_{rg}+n_{pg}} + \frac{PLR(1-PLR)}{n_{rl}+n_{pl}}}$$

where n_{rg}, n_{pg}, n_{rl}, and n_{pl} are the number of realized gains, paper gains, realized losses, and paper losses, respectively.

those for December, we follow Odean (1998) and perform our tests in December and January to November separately. Columns (2) and (3) report the results. We see that *PLR* is consistently larger than *PGR* in those two time periods and that the differences are both statistically significant. So we find no evidence for disposition effect in either December or January to November. These results suggest that PL insurers, as institutional investors, are more sophisticated than individual investors and are less likely subject to behavioral biases. Thus, we have more confidence to conclude that the familiarity of PL insurers with respect to the stocks in their own industry is likely driven by asymmetric information rather than a behavioral bias.

III. Institutional Details on the Property/Liability Insurance Industry

This appendix includes key industry fundamentals from 2001 to 2015 (see Table IA5), a decomposition of underwriting risk into systematic and unsystematic components (see Table IA6) and return correlations between PL stocks (see Table IA7).

PL insurers are financial intermediaries that underwrite risks of property damage and legal liability faced by individuals and corporations. They price these risks and invest premiums paid by policyholders that have not yet been paid out for claims. Table IA5 reports their two primary sources of income – underwriting and investment – in terms of premiums earned (Column 5) and investment gain (Column 9). In 2015, PL insurers had earned premiums of roughly $512 billion, investment holdings of almost $1.7 trillion (Column 2), and net investment gain of $63 billion. While the majority of PL insurer investments were in bonds, almost 30% were in common stock. Underwriting performance is measured by the loss ratio, which is the ratio of insurers’ loss costs to premiums earned. The volatility of the loss ratio is a commonly used measure of insurer underwriting risk.

To illustrate the constitution of insurers' underwriting risk, we decompose underwriting risk into systematic and idiosyncratic risk using a similar approach as in Witt and Urrutia (1983). Specifically, for each insurer with at least 10 valid observations for the loss ratio, we run the following regression:

(3) $Loss\ Ratio_{i,t} - \overline{Industry\ Loss\ Ratio} = \alpha_i + \beta_{i,t}\ (Industry\ Loss\ Ratio_t - \overline{Industry\ Loss\ Ratio}) + \varepsilon_{i,t}$

where $Loss\ Ratio_{i,t}$ denotes the loss ratio of an insurer i in year t; $Industry\ Loss\ Ratio_t$ denotes the loss ratio of the entire PL insurance industry in year t; $\overline{Industry\ Loss\ Ratio}$ denotes the average industry loss ratio over the entire sample period; α_i represents the intercept; $\beta_{i,t}$ represents the sensitivity (beta) of the deviation of the industry loss ratio from the average industry loss ratio to the deviation of the individual insurer's loss ratio from the average industry loss ratio; $\varepsilon_{i,t}$ represents the residual. To reduce the potential bias caused by outliers, insurers with non-positive losses incurred, loss adjustment expenses, or premiums earned are excluded, and the individual insurer's loss ratio is winsorized at the 1st and the 99th percentiles. For each insurer, the underwriting risk is measured as the standard deviation of loss ratio over the entire sample period from 2001 through 2015. Systematic risk is measured as the beta times the standard deviation of the industry loss ratio over the sample period. Idiosyncratic risk is the standard deviation of the residual over the sample period. Panel A of Table IA6 presents the results. We find that the average underwriting risk is 11.89 percent, within which the average systematic risk is 3.49 percent, as determined by the average beta of 0.66, and the average idiosyncratic risk is 10.49 percent.

Insurers are exposed to not only substantial systematic risk but also even larger idiosyncratic risk. The idiosyncratic risk within the property-liability insurance industry stems from various business lines and geographic areas in which insurers operate. It is expected to be smaller (greater) for larger (smaller) insurers, which are more (less) diverse. To confirm this intuition, we divide the insurers into quartiles based on the average firm size (average natural logarithm of total net admitted assets) and consider insurers in the first quartile as small insurers, those in the middle two quartiles as medium insurers, and those in the last quartile as large insurers. Panels B, C, and D report the summary statistics for those three types of insurers, respectively. We find that indeed, the systematic risk increases with the firm size, while the idiosyncratic risk decreases with it. Specifically, for large (small) insurers, the average systematic risk is 4.52 percent (2.33 percent), and the average idiosyncratic risk is 9.31 percent (13.15 percent).

We also shed some light on the return correlation between property-liability insurance stocks. Table IA7 exhibits the pairwise return correlation between all property-liability insurance stocks covered by CRSP throughout the period from 2001 through 2015. The average stock return correlation is 21.55 percent, and the median is 15.84 percent. Both statistics are positive, implying that the stock return of an insurer tends to be positively correlated with that of another insurer. As previously mentioned, the business lines and geographic areas in which insurers underwrite vary, and larger insurers are diverse than smaller insurers. A natural expectation is for larger insurers to be more highly correlated with one another because they have greater business and (or) geographic overlap. So we again divide the insurers into quartiles based on market capitalization and classify insurers in the first quartile as small insurers, those in the middle two quartiles as medium insurers, and those in the last quartile as large insurers. Table IA7 also presents the pairwise return correlation between these three types of insurers. We find that the correlation between large insurers is the highest, with an average of 44.28 percent. By contrast, the small insurers have the lowest pairwise correlation, the average of which is merely 3.89 percent.

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Table IA1
Hedging against the PL Insurance Industry (Pooled Tobit)

This table presents the results from the regression of the portfolio tilt toward the PL insurance industry on the underwriting risk. The dependent variables are the proportion of common stock portfolio (w_p) and industry bias (*IB*), respectively, in the PL insurance industry. The other variables are defined in Appendix B. The regression model is pooled Tobit. The standard errors are clustered at the year level. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Dependent Variable:	w_p	IB
	Tobit	Tobit
Model:	(1)	(2)
INTERCEPT	-0.1540***	-6.7529***
	(0.0378)	(0.9786)
UND_RISK	0.0025	0.0662
	(0.0034)	(0.1171)
AGE	-0.0101***	-0.3714***
	(0.0017)	(0.0676)
SIZE	0.0028	0.0850
	(0.0028)	(0.1185)
NPW_SIZE	-0.0052***	-0.1860***
	(0.0019)	(0.0693)
PUBLIC	0.0190**	0.6160**
	(0.0075)	(0.2606)
PTF_MV	0.0014	0.0586
	(0.0015)	(0.0636)
PTF_DIV	0.0384***	1.4125***
	(0.0015)	(0.0412)
MUTUAL	0.0009	0.0248
	(0.0029)	(0.1187)
REINSURANCE	-0.0112	-0.3818
	(0.0105)	(0.4567)
LONG_TAIL	-0.0121**	-0.4560**
	(0.0057)	(0.2057)
LINE_DIV	-0.0434***	-1.6072***
	(0.0121)	(0.4629)
GEO_DIV	0.0286***	1.0177***
	(0.0076)	(0.2610)
Year Fixed Effects	Yes	Yes
Line Fixed Effects	Yes	Yes
State Fixed Effects	Yes	Yes
N. of Obs.	11,517	11,517

Table IA2

Hedging across Industries (Pooled Tobit)

This table presents the results of hedging across industries. The dependent variables are the proportion of common stock portfolio (w_p) and industry bias (*IB*), respectively, in an industry. *IND_CORRELATION* is the correlation between the value-weighted return of PL insurance industry with another industry over the entire sample period. *HI_UND_RISK* is a dummy variable that is equal to 1 if an insurer's underwriting risk (*UND_RISK*) is equal to or greater than the median in a year and 0 otherwise. The regression model is pooled Tobit. The standard errors are clustered at the year level. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Dependent Variable:	w_p	IB	w_p	IB
	Tobit	Tobit	Tobit	Tobit
Model:	(1)	(2)	(3)	(4)
INTERCEPT	0.1052***	0.2849*	0.1052***	0.2853*
	(0.0067)	(0.1494)	(0.0067)	(0.1493)
IND_CORRELATION	-0.1226***	-1.7725***	-0.1165***	-1.6680***
	(0.0092)	(0.1789)	(0.0093)	(0.1839)
IND_CORRELATION * HI_UND_RISK			-0.0126***	-0.2132***
			(0.0012)	(0.0260)
N. of Obs.	161,238	161,238	161,238	161,238

Table IA3

PL Insurance Portfolio Allocation (Pooled Tobit)

This table presents the results of PL insurance portfolio allocation. The dependent variable is the proportion of an insurer's PL insurance stock portfolio in an individual stock ($w_{p,s}$). *CORRELATION* is the stock return correlation between a PL insurance stock and its stockholder in the years *t-3* to *t-1*. *HI_UND_RISK* is a dummy variable that is equal to 1 if a stockholder's underwriting risk (*UND_RISK*) is equal to or greater than the median in a year and 0 otherwise. *GEO_OVERLAP* is the proportion of a stockholder's states that overlap with those of a PL insurance stock in the combined states of these two insurers. *GEO_SIM* is the cosine similarity between a PL insurance stock and its stockholder's business weights across all U.S. states and territories. *LINE_OVERLAP* is the proportion of a stockholder's states that overlap with those of a PL insurance stock in the combined business lines of these two insurers. *LINE_SIM* is the cosine similarity between a PL insurance stock and its stockholder's business weights across all business lines. The regression model is pooled Tobit. The standard errors are clustered at the year level. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Dependent Variable:	$w_{p,s}$									
Model:	Tobit (1)	Tobit (2)	Tobit (3)	Tobit (4)	Tobit (5)	Tobit (6)	Tobit (7)	Tobit (8)	Tobit (9)	Tobit (10)
INTERCEPT	-2.2327***	-2.2287***	-1.7677***	-1.7580***	-1.7738***	-1.7700***	-1.7912***	-1.7779***	-1.7820***	-1.7745***
	(0.2510)	(0.2529)	(0.1244)	(0.1253)	(0.1263)	(0.1274)	(0.1263)	(0.1286)	(0.1273)	(0.1279)
CORRELATION	1.1604***	1.1781***								
	(0.1157)	(0.1151)								
CORRELATION * HI_UND_RISK		-0.1460								
		(0.0989)								
GEO_OVERLAP			0.0918***	0.1396***						
			(0.0160)	(0.0271)						
GEO_OVERLAP * HI_UND_RISK				-0.1264***						
				(0.0418)						
GEO_SIM					0.1227***	0.1566***				
					(0.0202)	(0.0313)				
GEO_SIM * HI_UND_RISK						-0.0862*				
						(0.0473)				
LINE_OVERLAP							0.1284***	0.1757***		
							(0.0201)	(0.0264)		
LINE_OVERLAP * HI_UND_RISK								-0.1673***		
								(0.0441)		
LINE_SIM									0.0933***	0.1378***
									(0.0161)	(0.0185)
LINE_SIM * HI_UND_RISK										-0.1389***
										(0.0191)
Stock & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of Obs.	31,932	31,932	189,983	189,983	185,825	185,825	189,983	189,983	189,983	189,983

Table IA4
Disposition Effect

This table tests the disposition effect by comparing the aggregate Proportion of Gains Realized (*PGR*) to the aggregate Proportion of Losses Realized (*PLR*). *PGR* is the number of realized gains divided by the number of realized gains plus the number of paper gains, and *PLR* is the number of realized losses divided by the number of realized losses plus the number of paper losses. Realized gains, paper gains, realized losses, and paper losses are aggregated over time and across all insurers. The results are reported for the entire year, for December only, and for January through November, respectively. The significance of the differences in proportions is indicated by the t-statistics, which test the null hypotheses that the differences in proportions are equal to 0 assuming that all realized gains, paper gains, realized losses, and paper losses result from independent decisions.

	Entire Year (1)	December (2)	Jan-Nov (3)
PLR	0.0254	0.0311	0.0246
PGR	0.0228	0.0293	0.0219
Difference in Proportions	0.0026	0.0018	0.0027
t-statistics	48.6993	10.4503	48.7743

Table IA5
PL Insurance Industry Statistics

This table reports, *inter alia*, PL insurers' two primary sources of income – underwriting and investment – in terms of premiums earned (Column 5) and investment gain (Column 9). Underwriting performance is measured by the loss ratio, which is the ratio of insurers' loss costs to premiums earned.

Year	Total Net Admitted Assets ($ billion) (1)	Total Invested Assets ($ billion) (2)	Common Stock ($ billion) (3)	% Common Stock (4) = (3) / (2)	Premiums Earned ($ billion) (5)	Incurred Losses ($ billion) (6)	Loss Adjustment Expenses ($ billion) (7)	Loss Ratio (8) = ((6) + (7)) / (5)	Net Investment Gain ($ billion) (9)	Return on Investment (10) = (9) / (2)
2001	1,096.27	871.84	238.77	27.39%	315.53	236.49	41.20	88.01%	47.95	5.50%
2002	1,166.15	917.90	213.76	23.29%	352.99	241.14	45.21	81.12%	46.60	5.08%
2003	1,313.54	1,046.25	256.07	24.47%	390.65	241.01	50.69	74.67%	48.23	4.61%
2004	1,430.61	1,148.65	284.20	24.74%	417.90	249.63	53.70	72.58%	52.55	4.57%
2005	1,543.01	1,241.27	300.73	24.23%	421.42	258.37	55.57	74.50%	65.01	5.24%
2006	1,632.09	1,343.99	333.45	24.81%	440.72	234.26	53.20	65.22%	63.51	4.73%
2007	1,629.83	1,411.28	348.51	24.69%	444.65	249.38	53.00	68.00%	70.64	5.01%
2008	1,571.47	1,329.14	299.30	22.52%	443.55	290.89	52.46	77.41%	37.95	2.86%
2009	1,630.98	1,396.47	340.75	24.40%	426.92	255.19	53.28	72.25%	46.64	3.34%
2010	1,689.96	1,457.67	345.13	23.68%	424.69	259.31	53.26	73.60%	64.93	4.45%
2011	1,732.81	1,485.14	366.06	24.65%	438.38	293.11	55.16	79.45%	63.77	4.29%
2012	1,795.22	1,536.73	400.84	26.08%	452.65	280.40	56.04	74.33%	63.65	4.14%
2013	1,894.63	1,639.14	469.49	28.64%	471.86	262.30	56.34	67.53%	74.81	4.56%
2014	1,958.76	1,696.14	490.04	28.89%	493.52	282.30	58.34	69.02%	71.63	4.22%
2015	1,976.71	1,698.74	487.37	28.69%	511.83	294.16	60.58	69.31%	63.47	3.74%

Table IA6
Underwriting Risk Decomposition

This table decomposes underwriting risk into systematic and idiosyncratic risk using a similar approach as in Witt and Urrutia (1983). For each insurer with at least 10 valid observations for the loss ratio, we run the following regression:

$$Loss\ Ratio_{i,t} - \overline{Industry\ Loss\ Ratio} = \alpha_i + \beta_{i,t}\ (Industry\ Loss\ Ratio_t - \overline{Industry\ Loss\ Ratio}) + \varepsilon_{i,t}$$

where $Loss\ Ratio_{i,t}$ denotes the loss ratio of an insurer i in year t; $Industry\ Loss\ Ratio_t$ denotes the loss ratio of the entire PL insurance industry in year t; $\overline{Industry\ Loss\ Ratio}$ denotes the average industry loss ratio over the entire sample period; α_i represents the intercept; $\beta_{i,t}$ represents the sensitivity (beta) of the deviation of the industry loss ratio from the average industry loss ratio to the deviation of the individual insurer's loss ratio from the average industry loss ratio; $\varepsilon_{i,t}$ represents the residual. To reduce the potential bias caused by outliers, insurers with nonpositive losses incurred, loss adjustment expenses, or premiums earned are excluded, and the individual insurer's loss ratio is winsorized at the 1st and the 99th percentiles. For each insurer, underwriting risk is measured as the standard deviation of loss ratio over the entire sample period. Systematic risk is measured as the beta times the standard deviation of the industry loss ratio. Idiosyncratic risk is the standard deviation of the residual. Idiosyncratic risk is expected to be smaller (greater) for larger (smaller) insurers, which are more (less) diverse. Panels B, C, and D report the summary statistics for small insurers (first size quartile), medium insurers, and large insurers (4th size quartile).

Variable Name	N (1)	Mean (2)	Median (3)	Min (4)	Max (5)	Std. Dev. (6)	1st Quartile (7)	3rd Quartile (8)
Panel A: All Insurers								
Underwriting Risk	1,176	0.1189	0.0995	0.0060	0.5391	0.0704	0.0712	0.1450
Beta	1,176	0.6633	0.6614	-3.3487	5.8030	0.9313	0.1853	1.1141
Systematic Risk	1,176	0.0349	0.0348	-0.1763	0.3055	0.0490	0.0098	0.0586
Idiosyncratic Risk	1,176	0.1049	0.0871	0.0058	0.5233	0.0684	0.0582	0.1327
Panel B: Small Insurers								
Underwriting Risk	294	0.1418	0.1273	0.0262	0.3637	0.0723	0.0864	0.1821
Beta	294	0.4434	0.4851	-3.3487	5.8030	1.0681	-0.1184	0.9648
Systematic Risk	294	0.0233	0.0255	-0.1763	0.3055	0.0562	-0.0062	0.0508
Idiosyncratic Risk	294	0.1315	0.1149	0.0262	0.3583	0.0693	0.0807	0.1704
Panel C: Medium Insurers								
Underwriting Risk	588	0.1112	0.0929	0.0060	0.4781	0.0621	0.0698	0.1336
Beta	588	0.6758	0.6416	-3.2185	4.7555	0.8807	0.1880	1.0631
Systematic Risk	588	0.0356	0.0338	-0.1694	0.2503	0.0464	0.0099	0.0560
Idiosyncratic Risk	588	0.0975	0.0828	0.0058	0.4735	0.0593	0.0573	0.1191
Panel D: Large Insurers								
Underwriting Risk	294	0.1114	0.0884	0.0152	0.5391	0.0787	0.0616	0.1328
Beta	294	0.8583	0.7932	-2.9626	4.3548	0.8342	0.4245	1.3161
Systematic Risk	294	0.0452	0.0418	-0.1559	0.2292	0.0439	0.0223	0.0693
Idiosyncratic Risk	294	0.0931	0.0761	0.0143	0.5233	0.0773	0.0474	0.1058

Table IA7
PL Insurance Stock Correlation

This table describes the return correlation between property-liability insurance stocks via pairwise return correlation between all property-liability insurance stocks covered by CRSP throughout the period from 2001 through 2015.

Variable Name	N (1)	Mean (2)	Median (3)	Min (4)	Max (5)	Std. Dev. (6)	1st Quartile (7)	3rd Quartile (8)
Correlation (All Insurers)	11,704	0.2155	0.1584	-0.7792	1.0000	0.1996	0.0603	0.3912
Correlation (Small Insurer, Small Insurer)	564	0.0389	0.0315	-0.7792	0.4846	0.1049	-0.0104	0.0849
Correlation (Medium Insurer, Medium Insurer)	2,856	0.2575	0.2299	-0.3775	1.0000	0.1877	0.1023	0.4234
Correlation (Large Insurer, Large Insurer)	866	0.4428	0.4678	-0.2719	0.9444	0.1641	0.3428	0.5634
Correlation (Small Insurer, Medium Insurer)	2,586	0.0821	0.0640	-0.3636	0.8630	0.1148	0.0170	0.1170
Correlation (Small Insurer, Large Insurer)	1,526	0.0877	0.0685	-0.6769	0.5165	0.1221	0.0212	0.1331
Correlation (Medium Insurer, Large Insurer)	3,306	0.3130	0.3332	-0.6688	0.7031	0.1823	0.1599	0.4544