Binary IFA-IRT Models in Mplus version 7.4

Example data: 635 older adults (age 80-100) self-reporting on 7 items assessing the Instrumental Activities of Daily Living (IADL) as follows:

 Housework (cleaning and laundry): 1=64% Bedmaking: 1=84% 	Two versions of a response format were available:
3. Cooking: 1=77% 4. Everyday shopping: 1=66%	Binary $\rightarrow 0$ = "needs help", 1 = "does not need help" Categorical $\rightarrow 0$ = "can't do it", 1="big problems", 2="some problems", 3="no problems"
 5. Getting to places outside of walking distance: 1=65% 6. Handling banking and other business: 1=73% 7. Using the telephone 1=94% 	Higher scores indicate greater function. We will look at each response format in turn.

Binary 2-PL Model Syntax (left) and 1-PL Model Syntax (right) using ML and a logit scale:

TITLE: Assess binary IADL items using 2PL	TITLE: Assess binary IADL items using 1PL
DATA: FILE IS ADL.dat;	DATA: FILE IS ADL.dat;
VARIABLE: NAMES ARE case dial-dia7 cial-cia7;	VARIABLE: NAMES ARE case dial-dia7 cial-cia7;
USEVARIABLES ARE dial-dia7;	USEVARIABLES ARE dial-dia7;
CATEGORICAL ARE dial-dia7;	CATEGORICAL ARE dial-dia7;
MISSING ARE .;	MISSING ARE .;
IDVARIABLE IS case;	IDVARIABLE IS case;
ANALYSIS: ESTIMATOR IS ML;	ANALYSIS: ESTIMATOR IS ML;
LINK IS LOGIT;	LINK IS LOGIT;
<pre>MODEL: Factor loadings all estimated in 2PL IADL BY dial-dia7*; Item thresholds all estimated [dial\$1-dia7\$1*]; Factor mean=0 and variance=1 for identification [IADL@0]; IADL@1;</pre>	<pre>MODEL: Factor loadings all held equal in 1PL IADL BY dia1-dia7* (loading); Item thresholds all estimated [dia1\$1-dia7\$1*]; Factor mean=0 and variance=1 for identification [IADL@0]; IADL@1;</pre>
OUTPUT: STDYX; ! Standardized solution	OUTPUT: STDYX; ! Standardized solution
RESIDUAL TECH10; ! Local fit info	RESIDUAL TECH10; ! Local fit info
SAVEDATA: SAVE = FSCORES; ! Save factor scores (thetas)	SAVEDATA: SAVE = FSCORES; ! Save factor scores (thetas)
FILE = IADL_2PLThetas.dat; ! File factor scores saved to	FILE = IADL_1PLThetas.dat; ! File factor scores saved to
PLOT: TYPE IS PLOT1; ! PLOT1 gets you sample descriptives TYPE IS PLOT2; ! PLOT2 gets you the IRT-relevant curves TYPE IS PLOT3; ! PLOT3 gets you descriptives for theta	PLOT: TYPE IS PLOT1; ! PLOT1 gets you sample descriptives TYPE IS PLOT2; ! PLOT2 gets you the IRT-relevant curves TYPE IS PLOT3; ! PLOT3 gets you descriptives for theta

Binary 2-PL Model Fit (left) and 1-PL Model Fit (right) using ML logit:

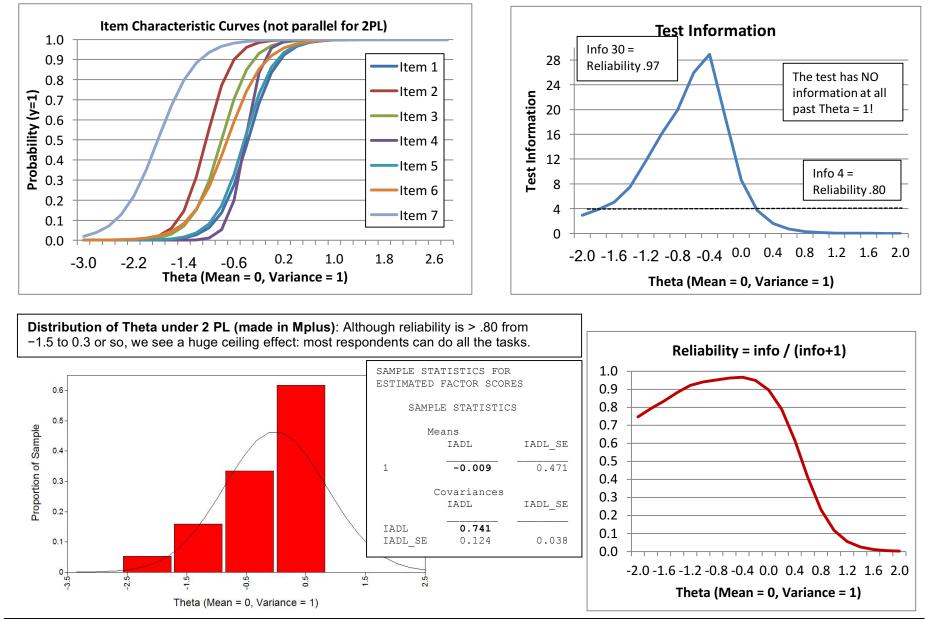
MODEL FIT INFORMATION - 2PL		MODEL FIT INFORMATION - 1 PL	
Number of Free Parameters	14	Number of Free Parameters	8
Loglikelihood		Loglikelihood	
H0 Value	-1454.634	H0 Value	-1464.457
Information Criteria		Information Criteria	
Akaike (AIC) Bayesian (BIC) Sample-Size Adjusted BIC (n* = (n + 2) / 24)	2937.268 2999.619 2955.170	Akaike (AIC) Bayesian (BIC) Sample-Size Adjusted BIC (n* = (n + 2) / 24)	2944.915 2980.544 2955.144
Chi-Square Test of Model Fit for th (Ordinal) Outcomes	e Binary and Ordered Categorical	Chi-Square Test of Model Fit for the (Ordinal) Outcomes**	e Binary and Ordered Categorical
Pearson Chi-Square		Pearson Chi-Square	
Value Degrees of Freedom P-Value	340.829 113 0.0000	Value Degrees of Freedom P-Value	296.199 118 0.0000
Likelihood Ratio Chi-Squa	re	Likelihood Ratio Chi-Squa	re
Value Degrees of Freedom P-Value	120.273 113 0.3023	Value Degrees of Freedom P-Value	126.354 118 0.2828
Linda Muthén suggests that if thes should not be used to assess mode		** Of the 630 cells in the latent c were deleted in the calculation	lass indicator table, 1 of chi-square due to extreme values.
Further, the possible total df for the possible response patterns. Here, 2PL model: $2^7 = 128$ possible – 7 le 1PL model: $2^7 = 128$ possible – 1 le	for 7 binary items: badings – 7 thresholds – 1 = 113	This error message indicates that t PL and 1-PL are not on the same s on the same data. So we can't com difference in model fit, but we can s	pare the chi-squares to test the
However, the 1PL only has df=118	because of the deleted cell.		

Does the 2-PL fit better than the 1-PL?

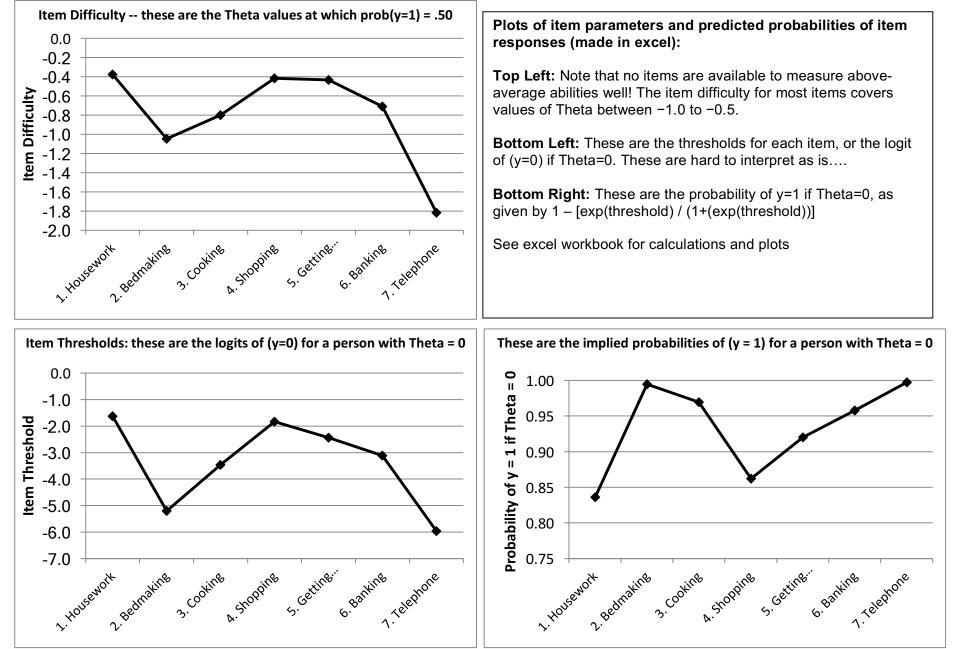
-1454.634*-2 = 2909.258 -2LL difference = 19.946, df = 6, p = .0032 AIC (but not BIC) is smaller for 2PL, too

3 differently scaled 2-PL solutions from ML logit provided by Mplus – all provide the exact same model predictions!

				wo-Tailed	WHERE THE LOC	GIT IS DISCRI	MINATION	I* (THETA -	DIFFICULTY)
	Estimate	S.E.	Est./S.E.	P-Value					
	S = CHANGE IN LOG	ידיד(v-1) סד		CF TN THETA	Item Discrimina	ations = SLOPE C	OF ICC AT F	2=.50	
ADL BY		,,	i outi cinii	SE IN INDIA	IADL BY				
DIA1	4.328	0.560	7.725	0.000	DIA1	4.328	0.560	7.725	0.000
DIA1 DIA2	4.978	0.808	6.159	0.000	DIA2	4.978	0.808	6.159	0.000
					DIA3	4.323	0.570	7.579	0.000
DIA3	4.323	0.570	7.579	0.000	DIA4	7.511	1.696	4.429	0.000
DIA4	7.511	1.696	4.429	0.000	DIA5	4.248	0.527	8.062	0.000
DIA5	4.248	0.527	8.062	0.000	DIA6	3.451	0.401	8.600	0.000
DIA6	3.451	0.401	8.600	0.000	DIA7	3.283	0.601	5.467	0.000
DIA7	3.283	0.601	5.467	0.000	DIA	3.205	0.001	5.407	0.000
					Item Difficulti	les = LOCATION O	OF ITEM ON	LATENT TRAIS	T at P=.50, LOG
	XPECTED LOGIT (Y=0	•		0 000	DIA1\$1	-0.376	0.052	-7.298	0.000
DIA1\$1	-1.629	0.295	-5.516	0.000	DIA2\$1	-1.045	0.065	-15.978	0.000
DIA2\$1	-5.202	0.770	-6.754	0.000	DIA3\$1	-0.801	0.059	-13.562	0.000
DIA3\$1	-3.462	0.441	-7.842	0.000	DIA4\$1	-0.415	0.035	-8.849	0.000
DIA4\$1	-3.120	0.744	-4.193	0.000	DIA5\$1 DIA5\$1	-0.413	0.047	-8.296	0.000
DIA5\$1	-1.833	0.298	-6.158	0.000					
DIA6\$1	-2.442	0.292	-8.368	0.000	DIA6\$1	-0.708	0.060	-11.889	0.000
DIA7\$1	-5.962	0.858	-6.951	0.000	DIA7\$1	-1.816	0.126	-14.454	0.000
ADL BY	S IN STANDARDIZED		5.		Threshold = expension $\pi -1$, threshold				
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6	0.922 0.940 0.922 0.972 0.920 0.885	0.018 0.018 0.018 0.012 0.018 0.022	51.712 52.557 50.622 80.380 52.291 39.729	0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres	nold becomes int ssion of item lo a in logit(y) fo	cercept: ex ogit on The or a one-un	spected logi eta wit change in	t for (y=1) ins n Theta
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7	0.922 0.940 0.922 0.972 0.920 0.885 0.875	0.018 0.018 0.018 0.012 0.018 0.022 0.037	51.712 52.557 50.622 80.380 52.291 39.729 23.380	0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models:	nold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(cercept: ex ogit on The or a one-un (Theta) →	spected logi eta hit change in if Theta=0,	t for (y=1) ins n Theta , prob(y=1)= .83
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 THRESHOLDS IN	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF	0.018 0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y)	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) =	nold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(cercept: ex ogit on The or a one-un (Theta) →	spected logi eta hit change in if Theta=0,	t for (y=1) ins n Theta , prob(y=1)= .83
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 CHRESHOLDS IN DIA1\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347	0.018 0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) =	nold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(cercept: ex ogit on The or a one-un (Theta) →	spected logi eta hit change in if Theta=0,	t for (y=1) ins n Theta , prob(y=1)= .83
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 PHRESHOLDS IN DIA1\$1 DIA2\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982	0.018 0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) = Logit (DIA7=1) =	nold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(cercept: ex ogit on The or a one-un (Theta) → (Theta) →	epected logi eta hit change in if Theta=0, if Theta=0,	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 THRESHOLDS IN DIA1\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347	0.018 0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) =	nold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(cercept: ex ogit on The or a one-un (Theta) → (Theta) →	epected logi eta hit change in if Theta=0, if Theta=0,	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 CHRESHOLDS IN DIA1\$1 DIA2\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982	0.018 0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) = Logit (DIA7=1) =	nold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(cercept: ex ogit on The or a one-un (Theta) → (Theta) →	epected logi eta hit change in if Theta=0, if Theta=0,	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 THRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739	0.018 0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.051	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) = Logit (DIA7=1) = USING RESULTS	nold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC	cercept: ex ogit on The or a one-un (Theta) → (Theta) →	epected logi ta hit change in if Theta=0, if Theta=0, GHT PANEL)	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 CHRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397	0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.051 0.045 0.048	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) = Logit (DIA7=1) = USING RESULTS IRT model: Logit	<pre>bold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC =(y=1) = a(theta)</pre>	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIC a - difficu	<pre>spected logi sta if change in if Theta=0, if Theta=0, SHT PANEL) alty)</pre>	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 CHRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404	0.018 0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.051 0.045	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) = Logit (DIA7=1) = USING RESULTS <u>IRT model: Logit</u> a = discriminati	<pre>bold becomes int ssion of item lo in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC =(y=1) = a(theta ion (rescaled s1</pre>	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIC a - difficu ope) = loa	<pre>spected logi sta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) iding/1.7</pre>	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 PHRESHOLDS IN DIA1\$1 DIA2\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590	0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.051 0.045 0.048 0.050 0.080	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	When *-1, thresh Loading = regres = change IFA Models: Logit (DIA1=1) = Logit (DIA7=1) = USING RESULTS IRT model: Logit	<pre>bold becomes int ssion of item lo in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC =(y=1) = a(theta ion (rescaled s1</pre>	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIC a - difficu ope) = loa	<pre>spected logi sta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) iding/1.7</pre>	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
EADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 DIA1\$1 CHRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA3\$1 DIA5\$1 DIA5\$1 DIA5\$1 DIA5\$1 DIA5\$1 DIA7\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590	0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.045 0.048 0.051 0.045 0.048 0.050 0.080	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558 -19.949	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	<pre>When *-1, thresh Loading = regres</pre>	<pre>bold becomes int ssion of item lo in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC =(y=1) = a(theta ion (rescaled s1</pre>	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIC a - difficu ope) = loa	<pre>spected logi sta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) iding/1.7</pre>	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 PHRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA4\$1 DIA5\$1 DIA4\$1 DIA5\$1 ACST = sta DIA1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590 Indardized loading 0.851	0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.051 0.045 0.048 0.050 0.080 0.080	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558 -19.949 25.856	0.000 0.0000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000000	<pre>When *-1, thresh Loading = regress</pre>	hold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC $\frac{1}{2}(y=1) = a(theta)$ fon (rescaled sl (location on lat	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIC a - difficu ope) = loa cent metric	<pre>spected logi ta hit change in if Theta=0, if Theta=0, SHT PANEL) htty) dding/1.7 s) = threshol</pre>	t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99 : :
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 PHRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA4\$1 DIA5\$1 DIA4\$1 DIA5\$1 AST DIA6\$1 DIA7\$1 AST DIA6\$1 DIA7\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590 Indardized loading 0.851 0.883	0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.051 0.045 0.048 0.050 0.080 0.080 0.033 0.034	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558 -19.949 25.856 26.278	0.000 0.000	<pre>When *-1, thresh Loading = regres</pre>	hold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC $\frac{1}{2}(y=1) = a(theta)$ (location on lat = 4.328*(Theta -	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIG <u>a - difficu</u> cope) = loa cent metric	<pre>spected logi eta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) dding/1.7 s) = threshol if Theta=0,</pre>	<pre>t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99 : ld/loading , prob(y=1)= .83</pre>
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 PHRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA4\$1 DIA5\$1 DIA5\$1 DIA6\$1 DIA7\$1 S-SQUARE = sta DIA1 DIA2 DIA3	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590 Indardized loading 0.851 0.883 0.850	0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.048 0.056 0.048 0.050 0.048 0.050 0.080 0.080 0.033 0.034 0.034	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558 -19.949 25.856 26.278 25.311	0.000 0.000	<pre>When *-1, thresh Loading = regress</pre>	hold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC $\frac{1}{2}(y=1) = a(theta)$ (location on lat = 4.328*(Theta -	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIG <u>a - difficu</u> cope) = loa cent metric	<pre>spected logi eta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) dding/1.7 s) = threshol if Theta=0,</pre>	<pre>t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99 : ld/loading , prob(y=1)= .83</pre>
ADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 PHRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA5\$1 DIA6\$1 DIA5\$	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590 Indardized loading 0.851 0.883 0.850 0.945	$\begin{array}{c} 0.018\\ 0.018\\ 0.018\\ 0.012\\ 0.018\\ 0.022\\ 0.037\\ \end{array}$ RIC = thres 0.048\\ 0.056\\ 0.051\\ 0.045\\ 0.048\\ 0.050\\ 0.080\\ \end{array} $\begin{array}{c} 0.033\\ 0.034\\ 0.034\\ 0.024\\ \end{array}$	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558 -19.949 25.856 26.278 25.311 40.190	0.000 0.000	<pre>When *-1, thresh Loading = regres</pre>	hold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC $\frac{1}{2}(y=1) = a(theta)$ (location on lat = 4.328*(Theta -	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIG <u>a - difficu</u> cope) = loa cent metric	<pre>spected logi eta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) dding/1.7 s) = threshol if Theta=0,</pre>	<pre>t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99 : ld/loading , prob(y=1)= .83</pre>
EADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 DIA181 DIA2\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA5\$1 DIA6\$1 DIA7\$1 DIA6\$1 DIA7\$1 DIA5\$1	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590 Indardized loading 0.851 0.883 0.850 0.945 0.846	0.018 0.018 0.012 0.018 0.022 0.037 RIC = thres 0.048 0.056 0.051 0.045 0.048 0.050 0.080 0.033 0.034 0.034 0.034 0.034 0.024 0.032	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558 -19.949 25.856 26.278 25.311 40.190 26.145	0.000 0.000	<pre>When *-1, thresh Loading = regres</pre>	hold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC $\frac{1}{2}(y=1) = a(theta)$ (location on lat = 4.328*(Theta -	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIG <u>a - difficu</u> cope) = loa cent metric	<pre>spected logi eta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) dding/1.7 s) = threshol if Theta=0,</pre>	<pre>t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99 : ld/loading , prob(y=1)= .83</pre>
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 THRESHOLDS IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta DIA1 DIA2 DIA3 DIA4	0.922 0.940 0.922 0.972 0.920 0.885 0.875 STANDARDIZED METF -0.347 -0.982 -0.739 -0.404 -0.397 -0.626 -1.590 Indardized loading 0.851 0.883 0.850 0.945	$\begin{array}{c} 0.018\\ 0.018\\ 0.018\\ 0.012\\ 0.018\\ 0.022\\ 0.037\\ \end{array}$ RIC = thres 0.048\\ 0.056\\ 0.051\\ 0.045\\ 0.048\\ 0.050\\ 0.080\\ \end{array} $\begin{array}{c} 0.033\\ 0.034\\ 0.034\\ 0.024\\ \end{array}$	51.712 52.557 50.622 80.380 52.291 39.729 23.380 hold/SD(Y) -7.303 -17.409 -14.373 -8.928 -8.348 -12.558 -19.949 25.856 26.278 25.311 40.190	0.000 0.000	<pre>When *-1, thresh Loading = regres</pre>	hold becomes int ssion of item lo a in logit(y) fo = 1.629 + 4.328(= 5.962 + 3.283(S FROM IRT MC $\frac{1}{2}(y=1) = a(theta)$ (location on lat = 4.328*(Theta -	cercept: ex ogit on The or a one-un (Theta) → (Theta) → ODEL (RIG <u>a - difficu</u> cope) = loa cent metric	<pre>spected logi eta hit change in if Theta=0, if Theta=0, SHT PANEL) hity) dding/1.7 s) = threshol if Theta=0,</pre>	<pre>t for (y=1) ins n Theta , prob(y=1)= .83 , prob(y=1)= .99 : ld/loading , prob(y=1)= .83</pre>



The estimated theta scores are supposed to have a mean of 0 and a variance of 1, but this table shows that they have a variance of only .741 instead. Such shrinkage is why it can be problematic to use these estimated theta scores as observed variables in other analyses.



Here is another estimation approach: a 2PL vs. a 1PL for Binary Responses using WLSMV Probit model

TITLE: 2PL Binary Model under WLSMV	TITLE: 1PL Binary Model under WLSMV
DATA: FILE IS ADL.dat;	DATA: FILE IS ADL.dat;
VARIABLE: NAMES ARE case dial-dia7 cial-cia7;	VARIABLE: NAMES ARE case dial-dia7 cial-cia7;
USEVARIABLES ARE dial-dia7;	USEVARIABLES ARE dial-dia7;
CATEGORICAL ARE dial-dia7;	CATEGORICAL ARE dial-dia7;
MISSING ARE .; IDVARIABLE is case;	MISSING ARE .; IDVARIABLE is case;
ANALYSIS: ESTIMATOR IS WLSMV; PARAMETERIZATION IS THETA;	
MODEL:	ANALYSIS: ESTIMATOR IS WLSMV; PARAMETERIZATION IS THETA;
! Factor loadings all estimated in 2PL	DIFFTEST=2PL.dat; ! Use saved info from bigger model
IADL BY dial-dia7*;	MODEL:
! Item thresholds all estimated	! Factor loadings all equal in 1PL
[dia1\$1-dia7\$1*];	IADL BY dial-dia7* (loading);
<pre>! Factor mean=0 and variance=1 for identification</pre>	! Item thresholds all estimated
[IADL@0]; IADL@1;	[dia1\$1-dia7\$1*];
	<pre>! Factor mean=0 and variance=1 for identification</pre>
OUTPUT: STDYX Residual; ! Standardized solution, local fit	[IADL@0]; IADL@1;
SAVEDATA: DIFFTEST=2PL.dat; ! Save info from bigger model	
SAVE = FSCORES; ! Save factor scores (thetas)	OUTPUT: STDYX Residual; ! Standardized solution, local fit
	OUTPUT: STDYX Residual; ! Standardized solution, local fit SAVEDATA:
FILE IS IADL_2PLThetas.dat; ! File factor scores saved to	
PLOT: TYPE IS PLOT1 PLOT2 PLOT3; ! Get IRT plots	SAVE = FSCORES; ! Save factor scores (thetas)
PLOT: TYPE IS PLOT1 PLOT2 PLOT3; ! Get IRT plots	FILE IS IADL_1PLThetas.dat; ! File factor scores saved to
MODEL FIT INFORMATION	PLOT: TYPE IS PLOT1 PLOT2 PLOT3; ! Get IRT plots
Number of Free Parameters 14	MODEL FIT INFORMATION
Chi-Square Test of Model Fit	Number of Free Parameters 8
Value 54.820*	
Degrees of Freedom 14	Chi-Square Test of Model Fit
P-Value 0.0000	Value 64.889*
	Degrees of Freedom 20
* The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV	P-Value 0.0000
cannot be used for chi-square difference testing in the regular way.	
MLM, MLR and WLSM chi-square difference testing is described on the	Chi-Square Test for Difference Testing
Mplus website. MLMV, WLSMV, and ULSMV difference testing is done	Value 18.450
using the DIFFTEST option.	
	P-Value 0.0052
RMSEA (Root Mean Square Error Of Approximation)	DNGER (Deet Meen Group Engen of Annual Statistics)
Estimate 0.068	RMSEA (Root Mean Square Error Of Approximation)
90 Percent C.I. 0.049 0.087	Estimate 0.059
Probability RMSEA <= .05 0.055	90 Percent C.I. 0.044 0.076
	Probability RMSEA <= .05 0.154
CFI/TLI	
CFI 0.997	CFI/TLI
TLI 0.995	CFI 0.996
	TLI 0.996
Chi-Square Test of Model Fit for the Baseline Model	WRMR (Weighted Root Mean Square Residual)
Value 12351.798	Value 1.501
Degrees of Freedom 21	
P-Value 0.0000	
WRMR (Weighted Root Mean Square Residual)	The Chi-Square for Difference Testing tells us directly that the
Value 1.160	2PL version of the binary model fits significantly better
	(now under WLSMV, same as it did under ML).

Here are the parameter estimates under WLSMV Theta Parameterization (Probit) for the 2PL version of binary items

	GED MODEL RESU	LTS (IF	A MODEL S	•						ODIE NEEDIC
	Estimate	0.5		Iwo-Tailed P-Value						OBIT METRIC
	Estimate	5.6.	Est./S.E.	P-value	WHERE THE	PROBIT I	S DISCR	IMINATI	ON* (THET	A - DIFFICULT
FACTOR LOADING	S = CHANGE IN PRO	BIT(Y=1) H	PER UNIT CH	ANGE IN THETA	Item Discri	minations				
IADL BY					IADL BY					
DIA1	2.686	0.317	8.461	0.000	DIA1		2.686	0.317	8.461	0.000
DIA2	2.941	0.493	5.966	0.000	DIA2		2.941	0.493	5.966	
DIA3	2.803	0.384	7.290	0.000	DIA2 DIA3		2.803	0.384	7.290	
DIA4	3.654	0.575	6.356	0.000			3.654	0.384	6.356	
DIA5	2.486	0.294	8.449	0.000	DIA4					
DIAG	1.991	0.223	8.940	0.000	DIA5		2.486	0.294	8.449	
DIA0 DIA7	1.571	0.223	5.246	0.000	DIA6		1.991	0.223	8.940	
DIAI	1.3/1	0.299	5.240	0.000	DIA7		1.571	0.299	5.246	0.000
		<u> </u>			Item Diffic					
	XPECTED PROBIT (Y=				DIA1\$1	-	0.374	0.055	-6.743	
DIA1\$1	-1.004	0.179	-5.607	0.000	DIA2\$1	-	1.053	0.069	-15.360	0.000
DIA2\$1	-3.097	0.481	-6.444	0.000	DIA3\$1	-	0.792	0.062	-12.863	0.000
DIA3\$1	-2.221	0.307	-7.240	0.000	DIA4\$1	-	0.433	0.054	-7.982	0.000
DIA4\$1	-1.581	0.298	-5.312	0.000	DIA5\$1	-	0.425	0.056	-7.607	0.000
DIA5\$1	-1.057	0.174	-6.071	0.000	DIA6\$1		0.699	0.063	-11.084	
DIA6\$1	-1.391	0.166	-8.359	0.000	DIA7\$1		1.875	0.154	-12.191	
DIA7\$1	-2.946	0.398	-7.401	0.000	D 1117 + 1		1.070	0.101	12.191	0.000
ACTOR LOADING	Estimate S IN STANDARDIZED		Est./S.E.	P-Value	Threshold =	PROBIT(y) = expected pr breshold >	obit of ((y=0) for	someone w	ith Theta=0
IADL BY	S IN STANDARDIZED	METRIC =	loading*SD	(Theta)/SD(Y)	Threshold = When *-1, t	expected pr	obit of (intercept	(y=0) for : expecte	someone w ed probit :	
IADL BY DIA1	S IN STANDARDIZED 0.937	METRIC = 0.013	loading*SD 69.487	(Theta)/SD(Y) 0.000	Threshold = When *-1, t	expected pr hreshold \rightarrow	obit of (intercept	(y=0) for : expecte	someone w ed probit :	ith Theta=0
IADL BY DIA1 DIA2	S IN STANDARDIZED 0.937 0.947	METRIC = 0.013 0.016	loading*SD 69.487 57.551	(Theta)/SD(Y) 0.000 0.000	Threshold = When *-1, t Loading = r	expected pr hreshold → egression of	obit of (intercept item pro	(y=0) for : expecte obit on Tl	someone w ed probit : heta	ith Theta=0
IADL BY DIA1 DIA2 DIA3	S IN STANDARDIZED 0.937 0.947 0.942	METRIC = 0.013 0.016 0.015	loading*SD 69.487 57.551 64.551	(Theta)/SD(Y) 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model:	expected pr hreshold → egression of Probit(y=1)	obit of (intercept item pro = a(theta	(y=0) for : expecte obit on T - diffic	someone w ed probit : heta culty)	ith Theta=0
IADL BY DIA1 DIA2 DIA3 DIA4	S IN STANDARDIZED 0.937 0.947 0.942 0.965	METRIC = 0.013 0.016 0.015 0.011	loading*SD 69.487 57.551 64.551 91.196	(Theta) /SD(Y) 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim	expected pr hreshold egression of Probit(y=1) ination (res	<pre>cobit of (intercept item pro = a(theta ccaled slop</pre>	(y=0) for : expecte obit on T - diffic ope) = loa	someone w ad probit : heta culty) ading/1	ith Theta=0 for (y=1) instead
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928	0.013 0.016 0.015 0.011 0.015	69.487 57.551 64.551 91.196 60.671	(Theta) /SD(Y) 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim	expected pr hreshold egression of Probit(y=1) ination (res	<pre>cobit of (intercept item pro = a(theta ccaled slop</pre>	(y=0) for : expecte obit on T - diffic ope) = loa	someone w ad probit : heta culty) ading/1	ith Theta=0
IADL BY DIA1 DIA2 DIA3 DIA4	S IN STANDARDIZED 0.937 0.947 0.942 0.965	METRIC = 0.013 0.016 0.015 0.011	loading*SD 69.487 57.551 64.551 91.196	(Theta) /SD(Y) 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim	expected pr hreshold egression of Probit(y=1) ination (res	<pre>cobit of (intercept item pro = a(theta ccaled slop</pre>	(y=0) for : expecte obit on T - diffic ope) = loa	someone w ad probit : heta culty) ading/1	ith Theta=0 for (y=1) instead
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928	0.013 0.016 0.015 0.011 0.015	69.487 57.551 64.551 91.196 60.671	(Theta) /SD(Y) 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim	expected pr hreshold egression of Probit(y=1) ination (res	<pre>cobit of (intercept item pro = a(theta ccaled slop</pre>	(y=0) for : expecte obit on T - diffic ope) = loa	someone w ad probit : heta culty) ading/1	ith Theta=0 for (y=1) instead
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894	0.013 0.016 0.015 0.011 0.015 0.020 0.046	69.487 57.551 64.551 91.196 60.671 44.371 18.195	(Theta) /SD(Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu	expected pr hreshold → egression of Probit(y=1) ination (res lty (locatio	cobit of (intercept item pro = a(theta caled slo on on late	(y=0) for : expecte whit on The a - diffic (ype) = loc ent metric	someone w ed probit : heta culty) ading/1 c) = thres	rith Theta=0 for (y=1) instead hold/loading
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET	0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = three	69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y	(Theta) /SD(Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN	cobit of (intercept item pro = a(theta caled slo on on late DARDIZEI	(y=0) for : expected whit on The a - diffication (ype) = location ent metric D RESID	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR	ith Theta=0 for (y=1) instead hold/loading ELATIONS
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350	METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = three 0.052	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790	(Theta) /SD(Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN	cobit of (intercept item pro = a(theta caled slo on on late DARDIZEI	(y=0) for : expected whit on The a - diffication (ype) = location ent metric D RESID	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR	rith Theta=0 for (y=1) instead hold/loading
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997	<pre>METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = thre 0.052 0.061</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474	(Theta) /SD (Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN	cobit of (intercept item pro = a(theta caled slo on on late DARDIZEI	(y=0) for : expected whit on The a - diffication (ype) = location ent metric D RESID	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR	ith Theta=0 for (y=1) instead hold/loading ELATIONS
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746	<pre>METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = thre 0.052 0.061 0.056</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326	(Theta) /SD (Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN	cobit of (intercept item pro = a(theta caled slo on on late DARDIZEI	(y=0) for : expected whit on The a - diffication (ype) = location ent metric D RESID	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR	ith Theta=0 for (y=1) instead hold/loading ELATIONS
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholts IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417	<pre>METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = thre 0.052 0.061 0.056 0.052</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041	(Theta) /SD (Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN	cobit of (intercept item pro caled slo on on late DARDIZEN IC CORRN	(y=0) for : expected which on The cont of the cont metric D RESID ELATION	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA!
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholts IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395	<pre>METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = thre 0.052 0.051 </pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676	(Theta) /SD (Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f	expected pr hreshold → egression of Probit(y=1) ination (res lty (location VIA STAN TETRACHOR	cobit of (intercept item pro caled slo on on late DARDIZEN IC CORRN	(y=0) for : expected which on The cont of the cont metric D RESID ELATION	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA!
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 0.417 -0.395 -0.624	<pre>0 METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = three 0.052 0.061 0.056 0.052 0.051 0.054</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648	(Theta) /SD (Y) 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f	expected pr hreshold → egression of Probit(y=1) ination (res lty (location VIA STAN TETRACHOR	cobit of (intercept item pro a (theta caled slo on on late DARDIZEI IC CORRI	(y=0) for : expecte whit on The pe) = loc ont metric D RESID ELATION .ations/Re	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholts IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395	<pre>METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = thre 0.052 0.051 </pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676	(Theta) /SD (Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f	expected pr hreshold → egression of Probit(y=1) ination (res lty (location VIA STAN TETRACHOR	cobit of (intercept item pro a (theta caled slo on on late DARDIZEI IC CORRI	(y=0) for : expecte whit on The pe) = loc ont metric D RESID ELATION .ations/Re	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582	METRIC = 0.013 0.016 0.015 0.011 0.020 0.046 RIC = three 0.052 0.061 0.056 0.052 0.051 0.054 0.081	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648	(Theta) /SD (Y) 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DIA1	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR	cobit of (intercept item pro a (theta caled slo on on late DARDIZEI IC CORRI	(y=0) for : expecte whit on The pe) = loc ont metric D RESID ELATION .ations/Re	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582 mdardized loading	<pre>METRIC = 0.013 0.016 0.015 0.011 0.020 0.046 RIC = thre 0.052 0.061 0.056 0.052 0.051 0.054 0.081 2 </pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648 -19.628	(Theta) /SD (Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DI DIA1 DIA2 0.	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR Cor Covariance A1 DIA2 	cobit of (intercept item pro = a(theta caled slo on on late DARDIZEI IC CORRI CORRI DIA3	(y=0) for : expecte whit on The pe) = loc ont metric D RESID ELATION .ations/Re	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta DIA1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582 mdardized loading 0.878	<pre>0 METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 PRIC = three 0.052 0.061 0.056 0.052 0.051 0.054 0.081</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648 -19.628 34.744	(Theta) /SD (Y) 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DIA DIA DIA2 0. DIA3 0.	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR For Covariance A1 DIA2 028 038 0.025	cobit of (intercept item pro a (theta caled slo on on late DARDIZEN IC CORRN DIA3	(y=0) for : expecte whit on The pe) = loc ont metric D RESID ELATION .ations/Re	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta DIA1 DIA2	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582 mdardized loading 0.878 0.896	<pre>0 METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = thre 0.052 0.061 0.056 0.052 0.051 0.054 0.081</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD (Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648 -19.628 34.744 28.775	(Theta) /SD (Y) 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DIA DIA1 DIA2 0. DIA3 0. DIA4 -0.	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR For Covariance A1 DIA2 	<pre>cobit of (intercept item pro accaled slo con on late DARDIZEN IC CORRN cos/Correl DIA3</pre>	(y=0) for : expected which on The compe) = low ent metric D RESID ELATION .ations/Re DIA4	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta DIA1	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582 mdardized loading 0.878	<pre>0 METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 PRIC = thre 0.052 0.051 0.054 0.054 0.081 2 0.025 0.031 0.027</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648 -19.628 34.744	(Theta) /SD (Y) 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DIA DIA1 DIA2 0. DIA3 0. DIA4 -0. DIA5 -0.	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR or Covariand A1 DIA2 028 038 0.025 022 -0.040 032 -0.034	<pre>cobit of (intercept item pro acaled slo con on late DARDIZEI IC CORRI CO</pre>	(y=0) for : expected bbit on The compe) = location commentation C RESIDE ELATION .ations/Reference DIA4 0.029	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co DIA5	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta DIA1 DIA2	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582 mdardized loading 0.878 0.896	<pre>0 METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 RIC = thre 0.052 0.061 0.052 0.051 0.054 0.051 0.054 0.081</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD (Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648 -19.628 34.744 28.775	(Theta) /SD (Y) 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DIA DIA2 0. DIA3 0. DIA4 -0. DIA5 -0. DIA6 -0.	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR Or Covariand A1 DIA2 028 038 0.025 032 -0.040 032 -0.034 052 -0.056	cobit of (intercept item pro a (theta caled slo on on late DARDIZEN IC CORRN DIA3 -0.046 -0.103 -0.046	(y=0) for : expected bbit on The content of	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co DIA5 	tith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DAS rrelations DIA6
<pre>IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta DIA1 DIA2 DIA3</pre>	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582 mdardized loading 0.878 0.896 0.887	<pre>0 METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 PRIC = thre 0.052 0.051 0.054 0.054 0.054 0.081</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648 -19.628 34.744 28.775 32.276	(Theta) /SD (Y) 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DIA DIA2 0. DIA3 0. DIA4 -0. DIA5 -0. DIA6 -0.	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR or Covariand A1 DIA2 028 038 0.025 022 -0.040 032 -0.034	cobit of (intercept item pro a (theta caled slo on on late DARDIZEN IC CORRN DIA3 -0.046 -0.103 -0.046	(y=0) for : expected bbit on The compe) = location commentation C RESIDE ELATION .ations/Reference DIA4 0.029	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co DIA5	ith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DA! prrelations
<pre>IADL BY DIA1 DIA2 DIA3 DIA4 DIA5 DIA6 DIA7 Thresholds IN DIA1\$1 DIA2\$1 DIA3\$1 DIA4\$1 DIA5\$1 DIA6\$1 DIA7\$1 R-SQUARE = sta DIA1 DIA2 DIA3 DIA4</pre>	S IN STANDARDIZED 0.937 0.947 0.942 0.965 0.928 0.894 0.844 STANDARDIZED MET -0.350 -0.997 -0.746 -0.417 -0.395 -0.624 -1.582 mdardized loading 0.878 0.896 0.887 0.930	<pre>0 METRIC = 0.013 0.016 0.015 0.011 0.015 0.020 0.046 PRIC = three 0.052 0.051 0.056 0.052 0.051 0.054 0.081 2 0.025 0.031 0.027 0.020</pre>	loading*SD 69.487 57.551 64.551 91.196 60.671 44.371 18.195 eshold/SD(Y -6.790 -16.474 -13.326 -8.041 -7.676 -11.648 -19.628 34.744 28.775 32.276 45.598	(Theta) /SD (Y) 0.000	Threshold = When *-1, t Loading = r IRT model: a = discrim b = difficu LOCAL FIT LEFTOVER Residuals f DIA DIA2 0. DIA3 0. DIA4 -0. DIA5 -0. DIA6 -0.	expected pr hreshold → egression of Probit(y=1) ination (res lty (location) VIA STAN TETRACHOR Or Covariand A1 DIA2 028 038 0.025 032 -0.040 032 -0.034 052 -0.056	cobit of (intercept item pro a (theta caled slo on on late DARDIZEN IC CORRN DIA3 -0.046 -0.103 -0.046	(y=0) for : expected bbit on The compe) = location C RESIDE ELATION .ations/Re DIA4 0.029 0.026	someone w ed probit : heta culty) ading/1 c) = thres UAL CORR (HOW FA esidual Co DIA5 	tith Theta=0 for (y=1) instead hold/loading ELATIONS R OFF FROM DAS rrelations DIA6