Supplemental Table 1. Descriptive Statistics

Variables	Total Sample	Categorical Puberty Categories: Pre-/Early Pubertal Group	Categorical Puberty Categories: Mid-/Late Pubertal Group
Sample Sizes:			
MZ Twins	466	302	164
DZ Twins	460	291	169
Total	***926***	***593***	***333***
Age:			
Range	8-16	8-15	9-16
Mean (SD)	11.71 (2.01)	10.60 (1.34)	13.68 (1.39)
Body Mass Index:			
Range	10.70-46.55	10.70-39.82	14.28-46.55
Mean (SD)	19.48 (4.50)	17.99 (3.58)	22.15 (4.75)
PDS Scores:			
Range	1.00-4.00	1.00-2.40	2.60-4.00
Mean (SD)	2.22 (0.88)	1.63 (0.43)	3.26 (0.40)
MEBS Total Score:			
Range (max score = 30)	0-27	0-25	0-27
Mean (SD)	4.42 (4.64)	3.93 (4.10)	5.30 (5.37)
Alphas	.87	.87	.86
% above the clinical cut-off	3.9%	2.6%	6.6%
Body Dissatisfaction:			
Range (max score = 6)	0-6	0-6	0-6
Mean (SD)	.95 (1.49)	0.69 (1.20)	1.42 (1.80)
Alphas	.77	.79	.75
Weight/Shape Concerns			
Range (max score = 12)	0-5.58	0-5.50	0-5.88
Mean (SD)	.75 (1.07)	.58 (.90)	1.07 (1.27)
Alphas	.92	.90	.93
Weight Preoccupation:			
Range (max score = 8)	0-8	0-8	0-8
Mean (SD)	1.73 (2.01)	1.61 (1.92)	1.94 (2.15)
Alphas	.78	.77	.79

Note: MZ= monozygotic; DZ= dizygotic; SD = standard deviation; PDS = Pubertal Development Scale; MEBS= Minnesota Eating Behavior Survey; % above clinical cut off = the percentage of twins who score above the clinical cut-off (score = 15.55) for the MEBS Total Score (see von Ranson et al., 2005). Pubertal group status was determined using an established cut-off (pre-early puberty: PDS score <2.5; mid-late puberty: PDS score ≥ 2.5) used in in past research (e.g., Culbert et al., 2009; Klump et al., 2003). Sample sizes indicate the number of twins (not number of twin pairs).

*p<.05, **$p < .01$.

Supplemental Table 2. Phenotypic Correlations between Weight and Shape Concerns Subscales and MEBS Total Score (N=926 individual twins)

	Body Dissatisfaction		Weight/Shape Concerns		Weight Preoccupation	
	r	% shared variance	r	% shared variance	r	% shared variance
Weight/Shape Concerns	.70***	49.0	1.00	-	-	-
Weight Preoccupation	.57***	32.5	.70***	49.0	1.00	-
Total Score	.76***	57.8	.79***	62.4	.88***	77.4

Note. % variance = variance that overlaps between the two constructs (i.e., r^2)
***p<.001

Supplemental Table 3. Model Fit Comparisons for Post-hoc Analyses that Regress Binge Eating Out of Weight/Shape Concerns and Regress Weight/Shape Concerns Out of Binge Eating (N=926 twins)

Model	-2lnL (df)	χ^2 Δ (df)	*p*	AIC	BIC	SABIC	DIC
Body Dissatisfaction with Binge Eating Regressed Out							
Full Model	2553.08(904)			745.08	-1497.71	-63.18	-666.99
Nested Submodels:							
No moderation	**2560.33(910)**	**7.25(6)**	**.30**	**740.33**	**-1512.50**	**-68.45**	**-676.27**
Constrain all nonlinear mods to 0	2558.66(907)	5.58(3)	.13	744.66	-1504.13	-64.84	-670.65
Constrain all nonlinear and linear A mods to 0	2559.38(908)	6.30(4)	.18	743.38	-1506.84	-65.96	-672.44
Constrain all nonlinear and linear C mods to 0	2559.67(908)	6.59(4)	.16	743.67	-1506.70	-65.82	-672.30
Constrain all nonlinear and linear E mods to 0	2558.91(908)	5.83(4)	.21	742.91	-1507.07	-66.19	-672.68
Constrain AE nonlinear mods to 0	2560.01(909)	6.93(5)	.23	742.01	-1509.59	-67.12	-674.28
Weight/ Shape Concerns with Binge Eating Regressed Out							
Full Model	2468.69(905)			658.69	-1542.98	-106.86	-711.34
Nested Submodels:							
No moderation	**2478.89 (911)**	**10.20(6)**	**.12**	**656.89**	**-1556.29**	**-110.65**	**-719.14**
Constrain all nonlinear mods to 0	2474.92(908)	6.23(3)	.10	658.92	-1549.07	-108.19	-714.67
Constrain all nonlinear and linear A mods to 0	2477.61(909)	8.92(4)	.06	659.61	-1550.79	-108.33	-715.48
Constrain all nonlinear and linear C mods to 0	2474.92(909)	6.23(4)	.18	656.92	-1552.14	-109.67	-716.82
Constrain all nonlinear and linear E mods to 0	2475.31(909)	6.62(4)	.16	657.31	-1551.94	-109.48	-716.63
Constrain all nonlinear & CE linear mods to 0	2475.31(910)	6.62(5)	.25	655.31	-1555.01	-110.96	-718.78
Weight Preoccupation with Binge Eating Regressed Out							
Full Model	2545.82(904)			737.82	-1501.34	-66.81	-670.62
Nested Submodels:							
No moderation	**2550.91(910)**	5.09(6)	.53	**730.91**	**-1517.21**	**-73.16**	**-680.98**
Constrain all non-linear mods to 0	2550.33(907)	4.51(3)	.21	736.33	-1508.30	-69.00	-674.82
Constrain all A mods to 0	2549.21(906)	3.39(2)	.18	737.21	-1505.79	-68.08	-673.23
Constrain all C mods to 0	2545.83(906)	0.01(2)	.99	733.83	-1507.48	-69.77	-674.92
Constrain all E mods to 0	2546.07(906)	0.25(2)	.88	734.07	-1507.36	-69.65	-674.80
Constrain A nonlinear mod to 0	2548.79(905)	2.97(1)	.08	738.79	-1502.93	-66.81	-671.29
Constrain E nonlinear mod to 0	2545.82(905)	0.00(1)	1.00	735.82	-1504.41	-68.29	-672.77
Constrain A nonlinear and all E mods to 0	2548.89(907)	3.07(3)	.38	734.89	-1509.02	-69.72	-675.54
Constrain E nonlinear and all A mods to 0	2549.37(907)	3.55(3)	.31	735.37	-1508.77	-69.48	-675.30

Supplemental Table 3 (Continued). Model Fit Comparisons for Post-hoc Analyses that Regress Binge Eating Out of Weight/Shape Concerns and Regress Weight/Shape Concerns Out of Binge Eating (N=926 twins)

Model	-2lnL (df)	χ^2 Δ (df)	*p*	AIC	BIC	SABIC	DIC
Binge Eating with Body Dissatisfaction Regressed Out							
Full Model	2529.29(904)			721.29	-1509.61	-75.08	-678.89
Nested Submodels:							
No moderation	2549.86(910)	20.57(6)	<.01	729.86	-1517.74	-73.69	-681.50
Constrain all A mods to 0	2534.84(906)	5.55(2)	.06	722.84	-1512.26	-75.26	-680.41
Constrain A nonlinear mod to 0	2529.33(905)	.04(1)	.84	719.33	-1512.66	-76.54	-681.02
Constrain C nonlinear mod to 0	2532.56(905)	3.27(1)	.07	722.56	-1511.04	-74.93	-679.41
Constrain all E mods to 0	2531.08(906)	1.79(2)	.41	719.08	-1514.85	-77.15	-682.29
Constrain all E mods and nonlinear A to 0	**2531.34(907)**	**2.05(3)**	**.56**	**717.34**	**-1517.79**	**-78.50**	**-684.31**
Binge Eating with Weight/Shape Concerns Regressed Out							
Full Model	2561.50(909)			743.50	-1508.85	-66.38	-673.53
Nested Submodels:							
No moderation	2580.46(915)	18.96(6)	<.01	750.46	-1517.78	-65.79	-676.95
Constrain all A mods to 0	2562.67(911)	1.17(2)	.56	740.67	-1514.40	-68.76	-677.25
Constrain A nonlinear mod to 0	2561.54(910)	0.04(1)	.84	741.54	-1511.90	-67.84	-675.66
Constrain C nonlinear mod to 0	2563.44(910)	1.94(1)	.16	743.44	-1510.94	-66.89	-674.71
Constrain all E mods to 0	2565.17(911)	3.67(2)	.16	743.17	-1513.15	-67.51	-676.00
Constrain all E mods and nonlinear A to 0	**2565.35(912)**	**3.85(3)**	**.28**	**741.35**	-1516.13	**-68.90**	**-678.06**
Binge Eating with Weight Preoccupation Regressed Out							
Full Model	2545.25(904)			737.24	-1501.63	-67.10	-670.91
Nested Submodels:							
No moderation	2568.26(910)	23.01(6)	<.01	748.26	-1508.54	-64.49	-672.30
Constrain all A mods to 0	2548.56(906)	3.31(2)	.19	736.56	-1506.11	-68.41	-673.55
Constrain A nonlinear mod to 0	2545.86(905)	.61(1)	.43	735.86	-1504.39	-68.27	-672.75
Constrain C nonlinear mod to 0	2545.41(905)	.16(1)	.69	735.41	-1504.62	-68.50	-672.98
Constrain all E mods to 0	2548.80(906)	3.55(2)	.17	736.80	-1505.99	-68.29	-673.43
Constrain all E mods and nonlinear A to 0	**2548.98(907)**	**3.73(3)**	**.29**	**734.98**	**-1508.97**	**-69.68**	**-675.49**

Note. -2lnL = minus twice the log-likelihood; χ^2 Δ= chi-square change; AIC = Akaike Information Criterion; Full Model = model with paths, linear, and quadratic moderators; A = additive genetic effects; C = shared environmental effects; E = nonshared environmental effects; mod(s) = moderator(s). Each nested submodel is compared to the full model when calculating the χ^2 Δ and degrees of freedom. The best-fitting models, as determined by a non-significant chi-square change test and the lowest AIC, BIC, SABIC, and DIC values, are noted by the outlined and bolded text. If fit statistics identify more than one model as best fitting, the model with the most model fit statistics indicating best fit was selected.

Supplemental Table 4. Unstandardized Path and Moderator Estimates for the Full and Best-Fitting Pubertal Moderation Models for Post-hoc Analyses that Regress Binge Eating Out of Weight/Shape Concerns and Regress Weight/Shape Concerns Out of Binge Eating (N=926 twins)

	Path Estimates			Linear Moderator Estimates			Nonlinear Moderator Estimates		
Model	a	c	e	β_X	β_Y	β_Z	β_X^2	β_Y^2	β_Z^2
Total Score Recalculated without Binge Eating Items									
Full Model	.42	-.53	-.87	.38	5.87	.43	-2.85	-8.16	-1.00
	(-.98, .98)	(-.94, .94)	(-1.00, -.66)	(-5.00, 5.00)	(-6.00, 6.00)	(-1.20, 1.50)	(-9.00, 9.00)	(-9.00, 9.00)	(-3.00, 1.66)
No Mods	.44	.00	**-.89**	-	-	-	-	-	-
	(-.57, .57)	(-.38, .38)	**(-.97, -.83)**	-	-	-	-	-	-
Body Dissatisfaction with Binge Eating Regressed Out									
Full Model	.08	-.67	**-.68**	1.96	1.20	-1.26	-1.94	1.45	2.22
	(-.59, .76)	(-.91, .91)	**(-.88, -.56)**	(-2.29, 5.00)	(-1.66, 3.88)	(-1.50, .23)	(-8.65, 4.78)	(-6.24, 6.09)	(-0.19, 3.15)
No Mods	**.60**	.00	**-.80**	-	-	-	-	-	-
	(.35, .69)	(-.42, .42)	**(-.87, -.73)**	-	-	-	-	-	-
Weight/ Shape Concerns with Binge Eating Regressed Out									
Full Model	.30	-.13	**.75**	1.59	4.08	-.04	-1.71	-8.13	-.22
	(-.43, .69)	(-.50, .44)	**(.52, .93)**	(-3.85, 5.00)	(-5.50, 5.50)	(-1.50, 1.50)	(-9.00, 7.98)	(-9.00, 9.00)	(-3.00, 2.39)
No Mods	.65	.00	**-.71**	-	-	-	-	-	-
	(.49, .74)	(-.37, .37)	**(-.78, -.65)**	-	-	-	-	-	-
Weight Preoccupation with Binge Eating Regressed Out									
Full Model	-.17	-.50	**-.77**	4.62	-.12	-.10	-8.84	.24	.02
	(-.66, .57)	(-.81, .08)	**(-.97, -.58)**	(-5.00, 5.00)	(-4.35, 4.02)	(-1.50, 1.49)	(-9.00, 9.00)	(-7.09, 8.10)	(-2.51, 2.44)
No Mods	.00	**-.56**	**-.82**	-	-	-	-	-	-
	(-.53, .53)	**(-.64, -.28)**	**(-.88, -.76)**	-	-	-	-	-	-
Binge Eating with recalculated Total Score Regressed Out									
Full Model	-.01	.04	**-.83**	.74	**4.37**	.99	1.09	-7.46	-1.73
	(-.48, .45)	(-.26, .33)	**(-.95, -.67)**	(-5.00, 4.77)	**(.79, 6.00)**	(-.24, 1.50)	(-6.13, 9.00)	(-9.00, 9.00)	(-3.00, .33)
No E Mods	.26	.08	**-.74**	**-1.90**	**4.16**	-	-	**-7.46**	-
No Nonlinear A	(-.32, .54)	(-.18, .34)	**(-.80, -.68)**	**(-2.55, -.79)**	**(1.67, 5.70)**	-	-	**(-9.00, -2.94)**	-

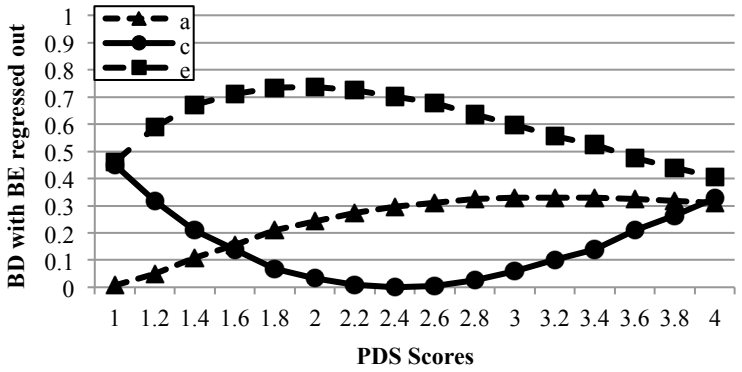
Supplemental Table 4. Unstandardized Path and Moderator Estimates for the Full and Best-Fitting Pubertal Moderation Models for Post-hoc Analyses that Regress Binge Eating Out of Weight/Shape Concerns and Regress Weight/Shape Concerns Out of Binge Eating (N=926 twins)

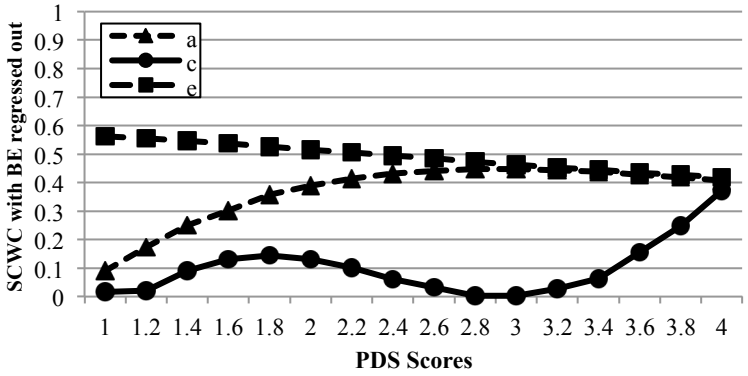
	Path Estimates			Linear Moderator Estimates			Nonlinear Moderator Estimates		
Model	a	c	e	β_X	β_Y	β_Z	β_X^2	β_Y^2	β_Z^2
Binge Eating with Body Dissatisfaction Regressed Out									
Full Model	.04	.05	**-.84**	1.62	4.30	.84	-.96	-8.16	-1.46
	(-.41, .44)	(-.27, .35)	**(-.98, -.71)**	(-5.00, 5.00)	(-5.97, 5.97)	(-.37, 1.50)	(-9.00, 9.00)	(-9.00, 9.00)	(-3.00, .65)
No E Mods	.07	.08	**-.78**	**-1.36**	**4.23**	-	-	**-8.07**	-
No Nonlinear A	(-.40, .47)	(-.26, .35)	**(-.84, -.71)**	**(-2.19, -.43)**	**(1.75, 5.45)**	-	-	**(-9.00, -3.49)**	-
Binge Eating with Weight/Shape Concerns Regressed Out									
Full Model	.01	.00	**-.91**	3.32	3.90	1.25	-6.73	-5.91	-2.31
	(-.43, .43)	(-.33, .34)	**(-1.00, -.77)**	(-5.00, 5.00)	(-6.00, 6.00)	(-.03, 1.50)	(-9.00, 9.00)	(-9.00, 9.00)	(-3.00, .08)
No E Mods	.15	.03	**-.82**	**-1.26**	**4.35**	-	-	**-7.67**	-
No Nonlinear A	(-.41,.52)	(-.30, .31)	**(-.88, -.76)**	**(-2.09, -.04)**	**(1.90, 5.78)**	-	-	**(-9.00, -3.26)**	
Binge Eating with Weight Preoccupation Regressed Out									
Full Model	.01	.08	**-.82**	3.28	3.22	.84	-4.52	-6.88	-1.91
	(-.44, .40)	(-.41, .42)	**(-.96, -.69)**	(-5.00, 5.00)	(-6.00, 6.00)	(-0.58, 1.50)	(-9.00, 9.00)	(-9.00, 9.00)	(-3.00, .57)
No E Mods	.06	.03	**-.81**	**-1.31**	**4.30**	-	-	**-8.27**	-
No Nonlinear A	(-.33,.41)	(-.25, .31)	**(-.87, -.75)**	**(-2.07, -.52)**	**(1.79, 5.45)**	-	-	**(-9.00, -3.65)**	-

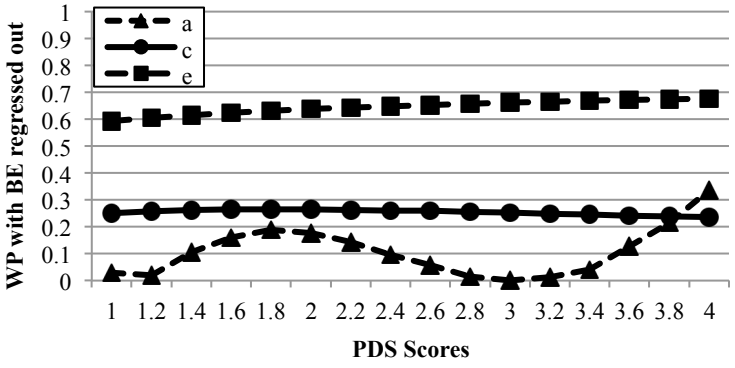
Note. MEBS= Minnesota Eating Behavior Survey; a = genetic path estimate; c = shared environmental path estimate; e = non-shared environmental path estimate; β_X = linear moderator of genetic path estimate; β_Y = linear moderator of shared environmental path estimate; β_Z =linear moderator of non-shared environmental path estimates; β_X^2= nonlinear moderator of genetic path estimate; β_Y^2= nonlinear moderator of shared environmental path estimate; β_Z^2= nonlinear moderator of non-shared environmental path estimate. Estimates are followed by 95% confidence intervals in parentheses. Confidence intervals that do not overlap with zero indicate statistical significance (bolded) at $p < .05$. In the "Full" model, genetic, shared environmental, and non-shared environmental estimates are allowed to vary both linearly and nonlinearly across levels of the moderator (i.e., pubertal development). The best fitting model is listed below the full model and denoted by an asterisk.

Supplemental Figure 1. Unstandardized Estimates of Additive Genetic (a), Shared Environmental (c), and Nonshared Environmental (e) Effects from the Full and Best-Fitting Models for Total Score, Body Dissatisfaction, Weight/Shape Concerns and Weight Preoccupation all with Binge Eating, Age, and BMI regressed out and then Full and Best-Fitting Models for Binge Eating with Body Dissatisfaction, Weight/Shape Concerns, and Weight Preoccupation regressed out with age and BMI. Although log-transformed PDS scores that were floored to 0 were used in all models (see Methods), raw PDS scores are depicted here for ease of interpretation.

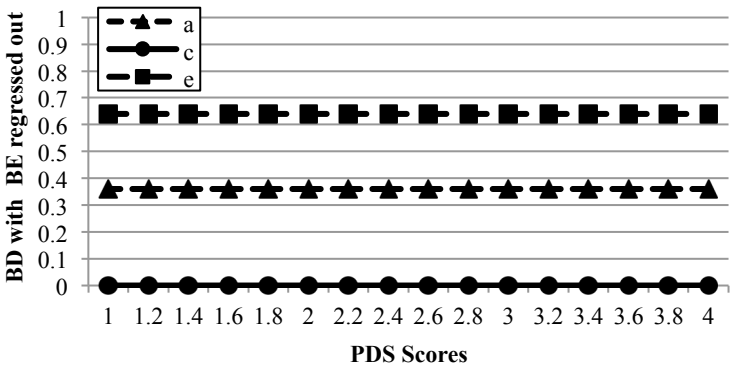
Full Model

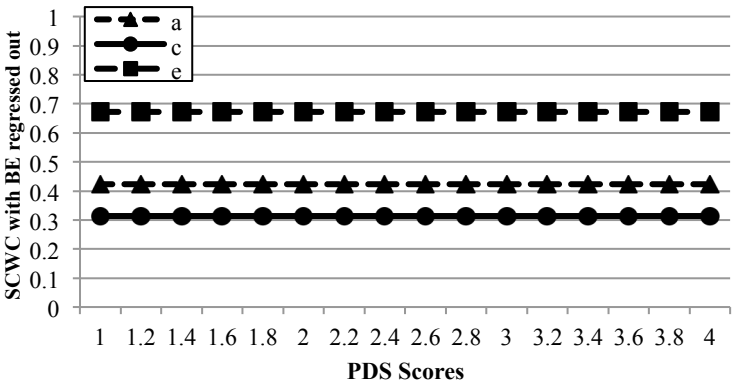


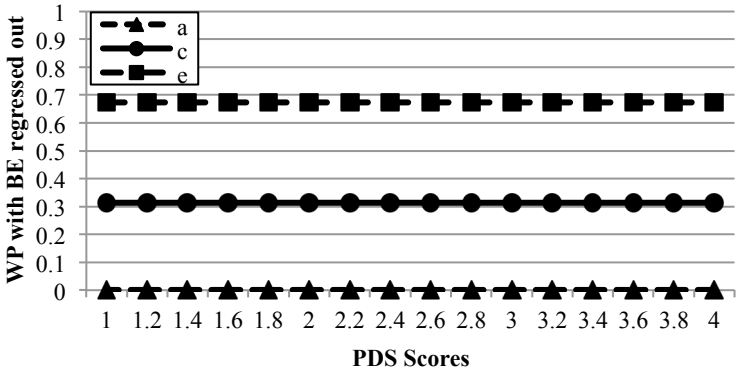




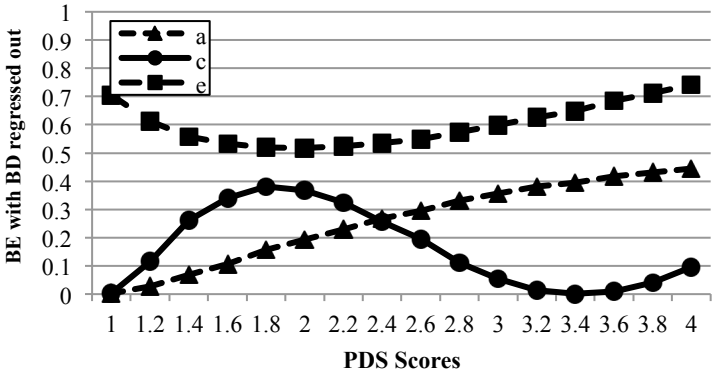
Best-Fitting Model



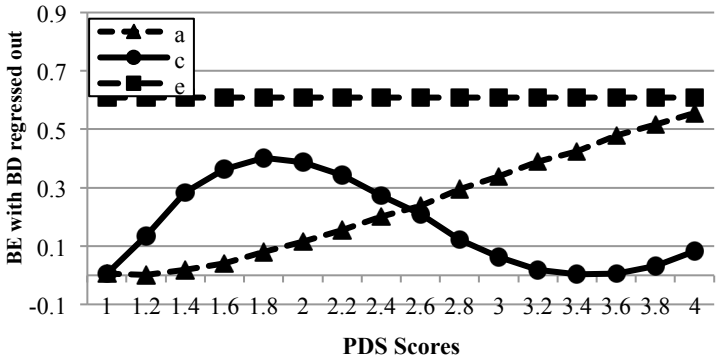


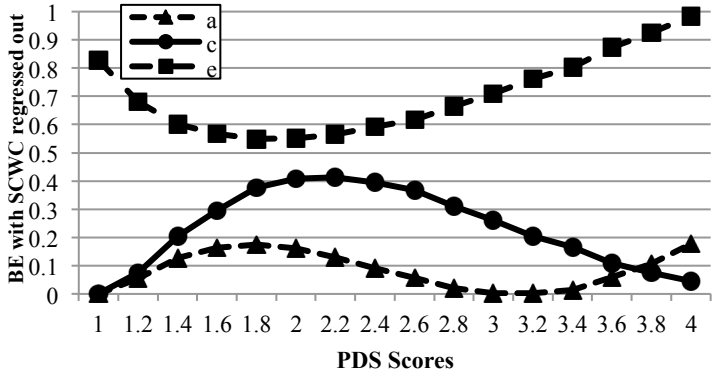


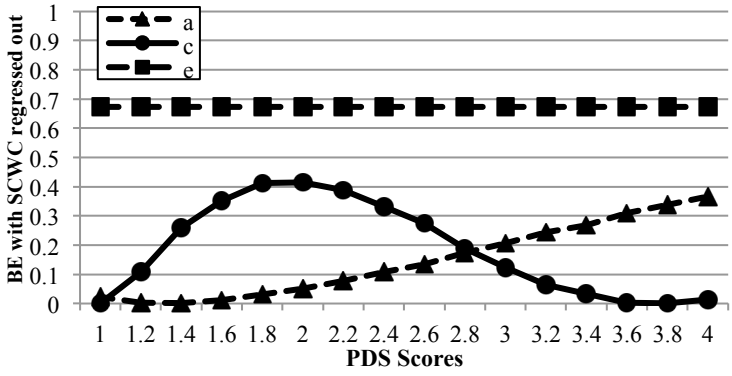
Full Model

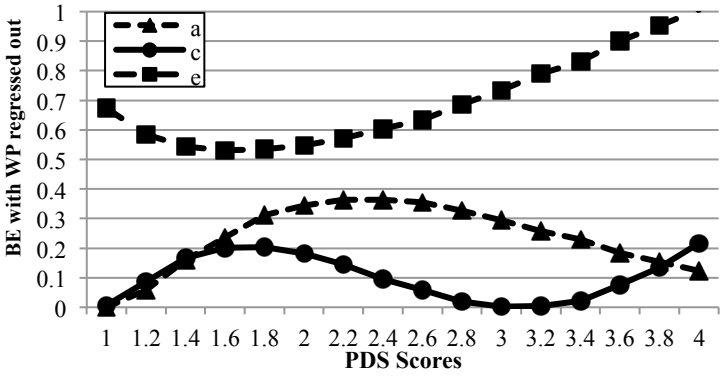


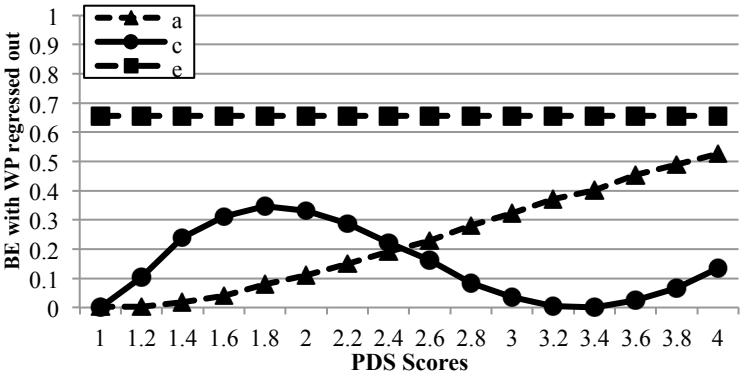
Best-Fitting Model











Supplemental Materials 1. Extended Univariate Mx Script

```
!EXTENDED UNIVARIATE SCRIPT
VARIABLE PEDIGREE EXAMPLE FOR NEAD DATA
DATA CALCULATION NG=3
BEGIN MATRICES;
  A full 1 1 free          ! genetic path coefficients
  C full 1 1 free          ! shared environment path coefficients
  E full 1 1 free          ! nonshared environment path coefficients
  T full 1 1 free          ! moderated genetic
  U full 1 1 free          ! moderated shared env
  V full 1 1 free          ! moderated nonshared env
  X full 1 1 free          ! quadratic moderation of A
  Y full 1 1 free          ! quadratic moderation of C
  Z full 1 1 free          ! quadratic moderation of E
  M full 1 1 free                  ! grand mean MZ
  N full 1 1 free                  ! grand mean DZ
  B full 1 1 free          ! moderator-linked mean model MZ1
  D full 1 1 free          ! moderator-linked mean model DZ1
  F full 1 1 free          ! moderator-linked mean model MZ2
  G full 1 1 free          ! moderator-linked mean model DZ2
  R full 1 1 free          !  twin 1 moderator (definition variable)
  S full 1 1 free          !  twin 2 moderator (definition variable)
  H full 1 1
  I full 1 1
END MATRICES;
Ma T 0.5
Ma U 1
Ma V 1
Ma X 0
Ma Y 0
Ma Z 0
Ma M 0
Ma B 0.2
Ma N 0.1
Ma F 0.2
Ma G 0.4
Ma D 0.2
Ma A 0.3
Ma C 0.4
Ma E 0.5
MATRIX H
0.5
BO -1 1 all
BO -5 5 T 1 1
BO -6 6 U 1 1
BO -1.5 1.5 V 1 1
BO -9 9 X 1 1
BO -9 9 Y 1 1
BO -3 3.5 Z 1 1
OPTIONS NO_Output JIGGLE TH=12
```

```
END

GROUP #3 IS mz
DATA NI=5
MISSING =9999.000
RECTANGULAR FILE=[ENTER PATHWAY TO .DAT FILE HERE]
LABELS Zyg MEBS MEBSb Pub Pubb
SELECT IF Zyg = 1 / ! THESE ARE THE MZs
SELECT MEBS MEBSb Pub Pubb /
DEFINITION Pub Pubb  /
MATRICES = GROUP 1
Means  M + B*R + F*S | M + F*S + B*R /
 Covariance
(A+T*R+X*R*R)*(A+T*R+X*R*R)' + (C+U*R+Y*R*R)*(C+U*R+Y*R*R)' +
(E+V*R+Z*R*R)*(E+V*R+Z*R*R)'
| (A+T*R+X*R*R)*(A+T*S+X*S*S)' +  (C+U*R+Y*R*R)*(C+U*S+Y*S*S)'
_ (A+T*S+X*S*S)*(A+T*R+X*R*R)' + (C+U*S+Y*S*S)*(C+U*R+Y*R*R)'
| (A+T*S+X*S*S)*(A+T*S+X*S*S)' + (C+U*S+Y*S*S)*(C+U*S+Y*S*S)' +
(E+V*S+Z*S*S)*(E+V*S+Z*S*S)' /
! twin 1 MODERATOR VARIABLE
SPECIFY R  -1
! twin 2 MODERATOR VARIABLE
SPECIFY S  -2
END

GROUP #2 IS dz
DATA NI=5
MISSING =9999.000
RECTANGULAR FILE=[ENTER PATHWAY TO .DAT FILE HERE]
LABELS Zyg MEBS MEBSb Pub Pubb
SELECT IF Zyg = 2 / ! THESE ARE THE DZs
SELECT MEBS MEBSb Pub Pubb /
DEFINITION Pub Pubb  /
MATRICES = GROUP 1
Means  N + D*R + G*S | N + G*S + D*R /
 Covariance
(A+T*R+X*R*R)*(A+T*R+X*R*R)' + (C+U*R+Y*R*R)*(C+U*R+Y*R*R)' +
(E+V*R+Z*R*R)*(E+V*R+Z*R*R)'
| H@(A+T*R+X*R*R)*(A+T*S+X*S*S)' +  (C+U*R+Y*R*R)*(C+U*S+Y*S*S)'
_ H@(A+T*S+X*S*S)*(A+T*R+X*R*R)' + (C+U*S+Y*S*S)*(C+U*R+Y*R*R)'
| (A+T*S+X*S*S)*(A+T*S+X*S*S)' + (C+U*S+Y*S*S)*(C+U*S+Y*S*S)' +
(E+V*S+Z*S*S)*(E+V*S+Z*S*S)' /
! twin 1 MODERATOR VARIABLE
SPECIFY R  -1
! twin 2 MODERATOR VARIABLE
SPECIFY S  -2
END
```