Genetic Growth Curve Models

Practica

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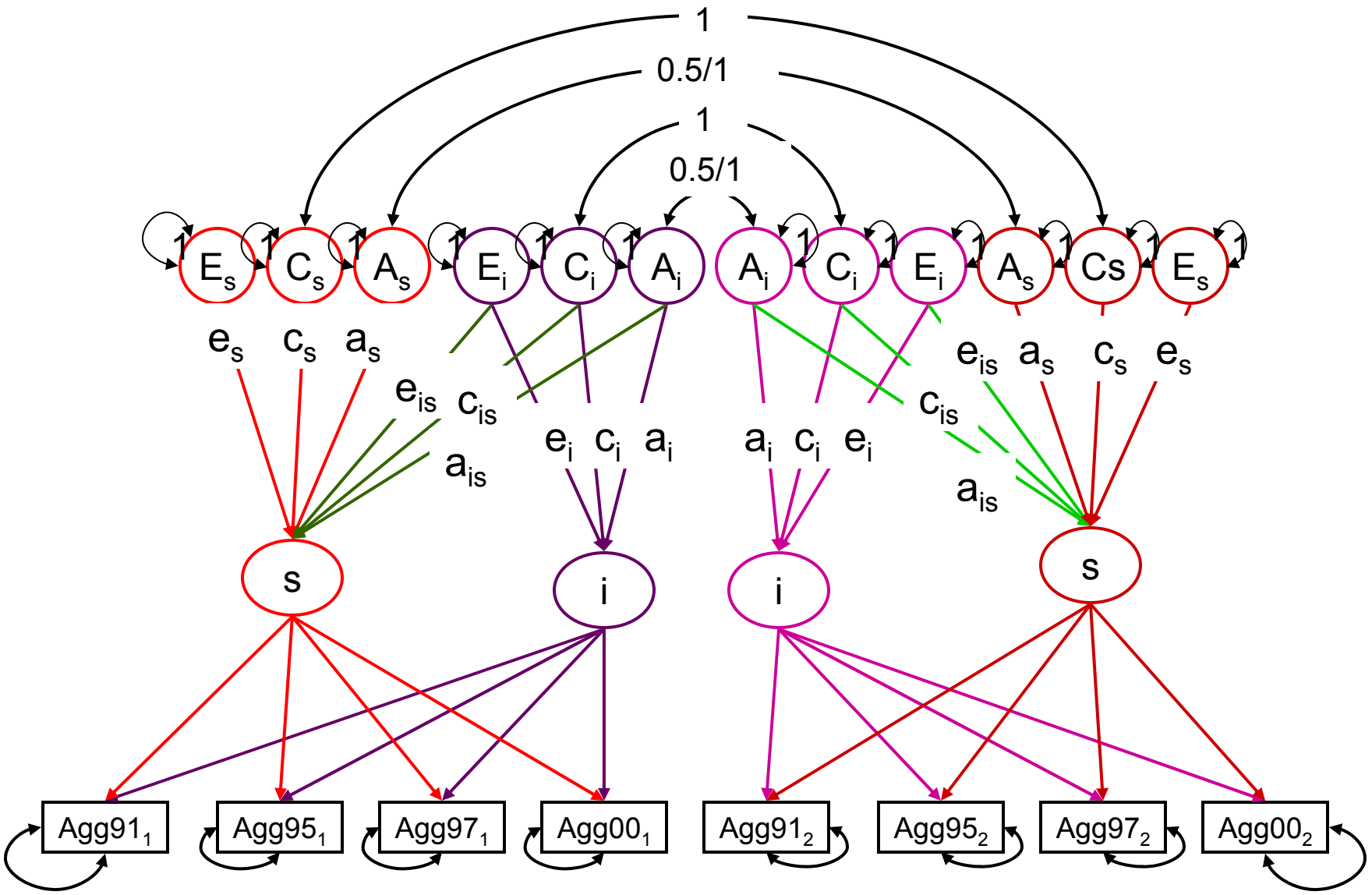
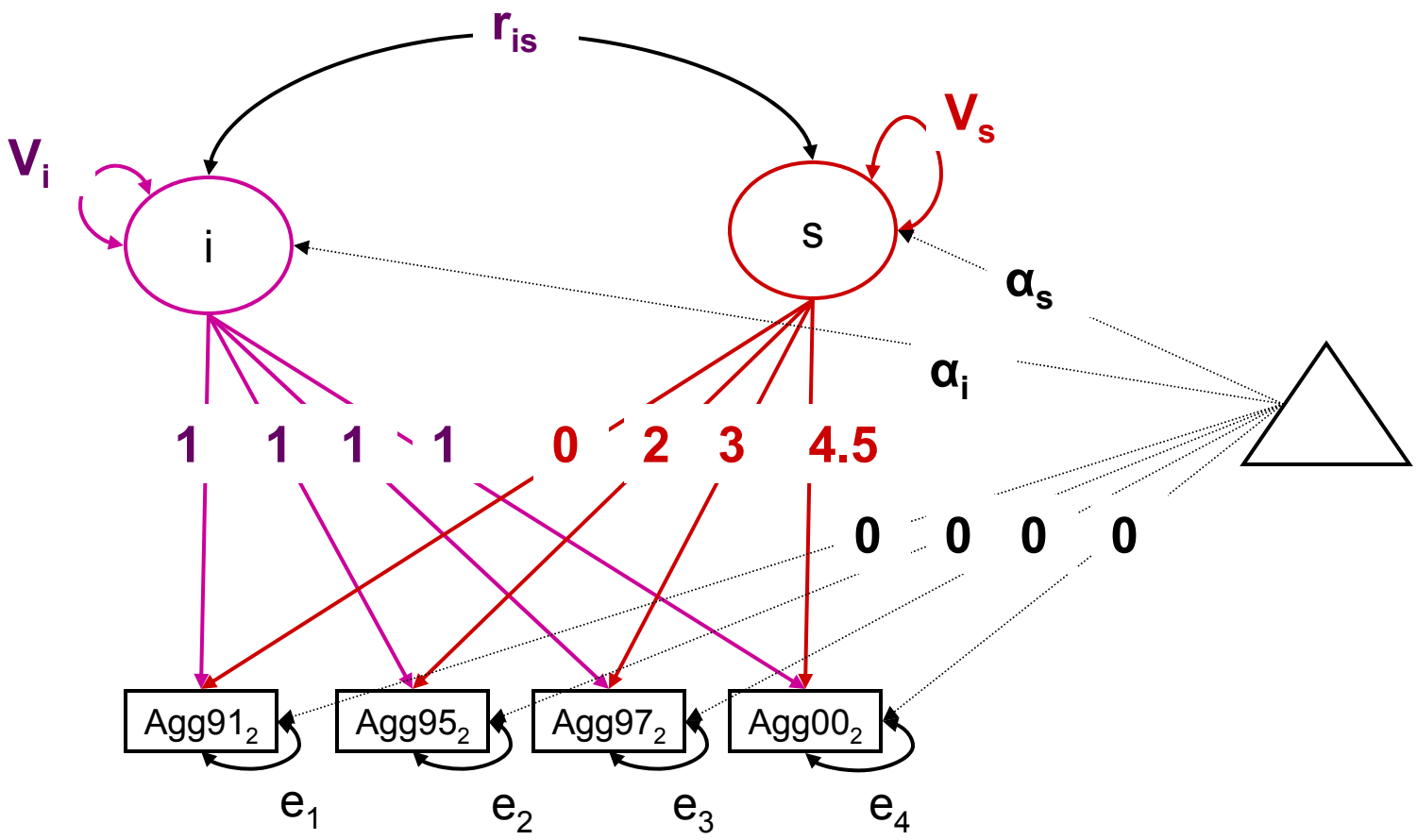
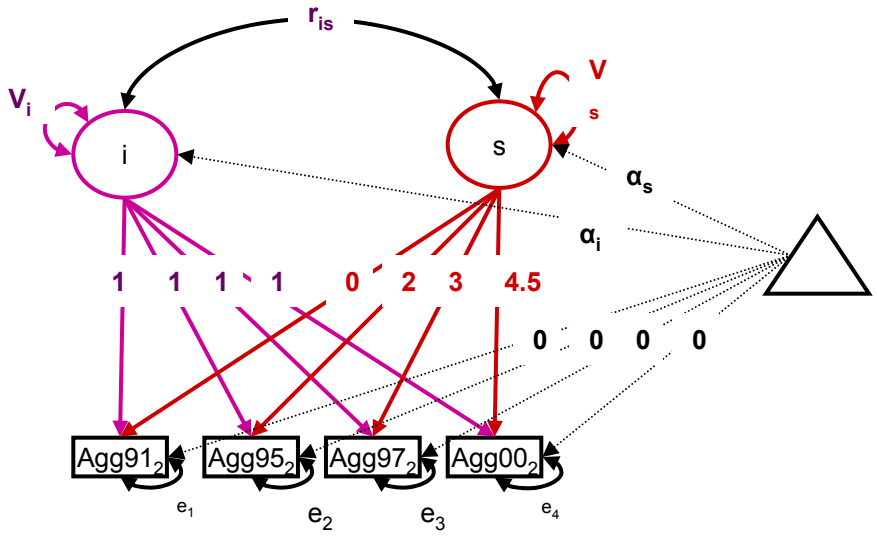
Genetic Growth Curve Model



1. Phenotypic Growth Curve Model



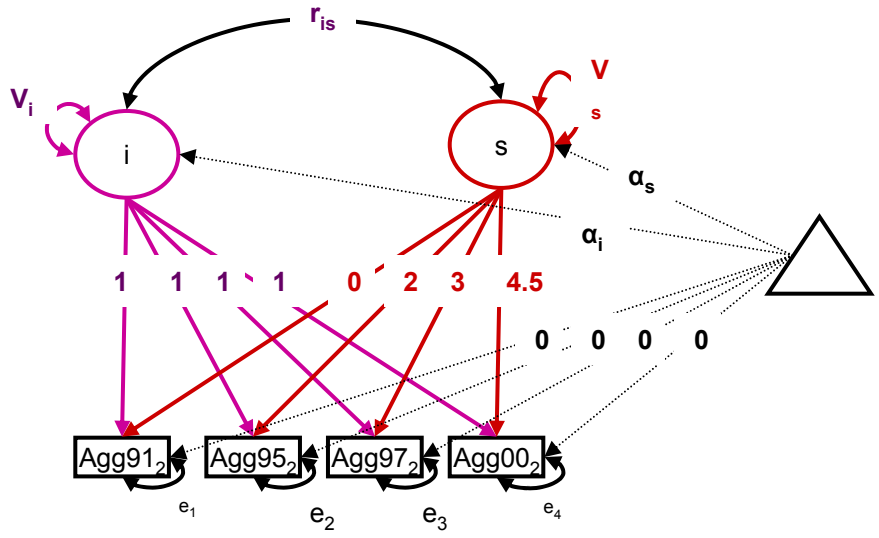
1. Phenotypic Growth Curve Model: Matrices



phenLingrow_lib08.mx

RUN

1. Phenotypic Growth Curve Model: Matrices



COVARIANCES

$$F = \begin{bmatrix} 1 & 0 \\ 1 & 2 \\ 1 & 3 \\ 1 & 4.5 \end{bmatrix} \qquad R = \begin{bmatrix} e_1 & & & \\ & e_2 & & \\ & & e_3 & \\ & & & e_4 \end{bmatrix}$$

$$M = \begin{bmatrix} V_i & r_{is} \\ r_{is} & V_s \end{bmatrix} \qquad COV = F \;\&\; M + R$$

$$COV = F * M * F' + R$$

MEANS

$$Q\begin{bmatrix} \alpha_i \\ \alpha_s \end{bmatrix} \qquad N = \begin{bmatrix} \beta_1 & \beta_2 & \beta_3 & \beta_4 \end{bmatrix}$$

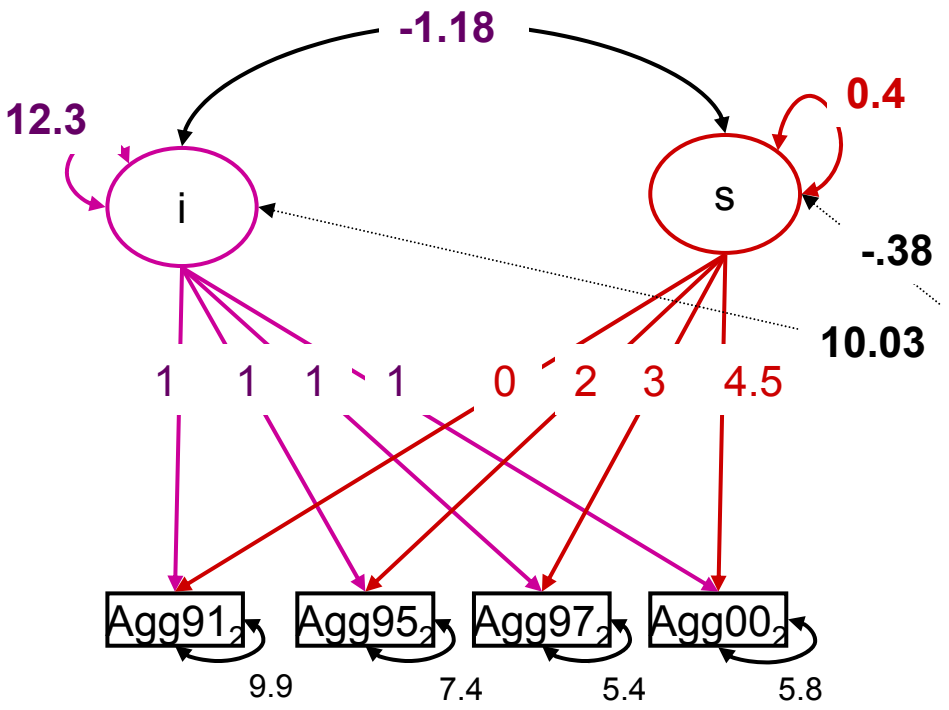
$$K = \begin{bmatrix} Age1 & Age2 & Age3 & Age4 \end{bmatrix}$$

$$MEANS = (F * Q)' + K \bullet N$$

$$\begin{bmatrix} \alpha_i + \beta_1 Age_1 & \alpha_i + 2\alpha_s + \beta_2 Age_2 & \alpha_i + 3\alpha_s + \beta_3 Age_3 & \alpha_i + 4.5\alpha_s + \beta_4 Age_4 \end{bmatrix}$$

1. Phenotypic Growth Curve Model: Run!

phenLingrow_lib08.mx



FIT: $\Delta\chi^2$ **(5)= 28.78, p<.01**

RMSEA = .0364

POSSIBLE SUBMODELS:

1. **Sig. Variation on Slope?**
2. **Sig i-s covariance?**
3. **Age effect = across surveys?**
4. **Significant change across time (α_s)?**

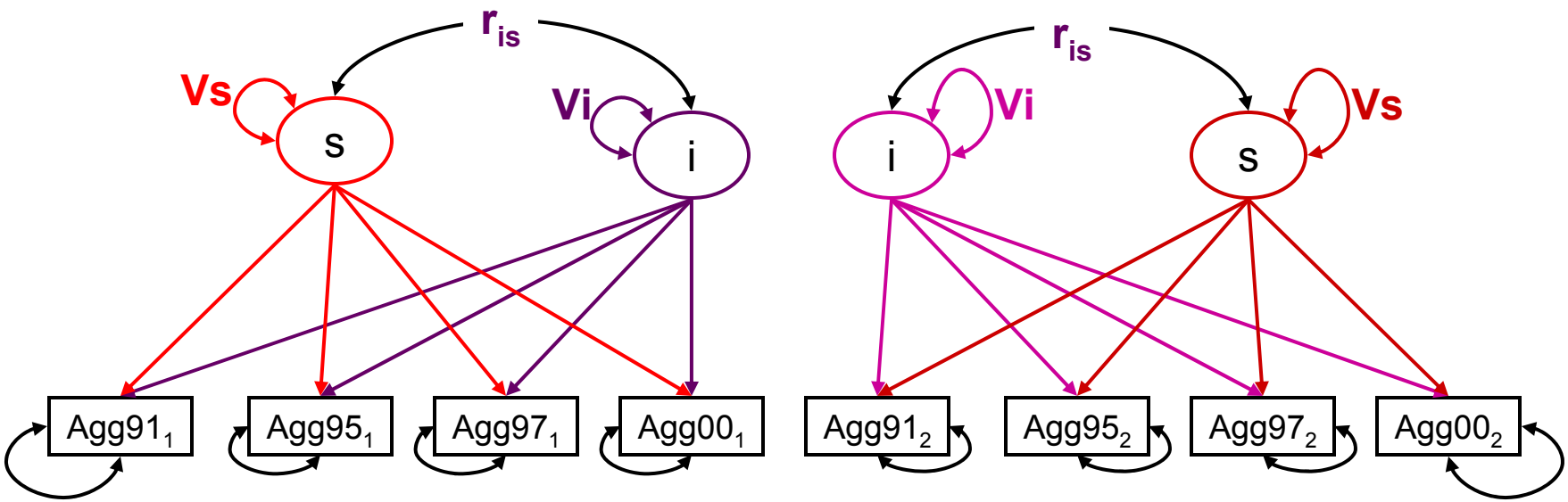
→ **All significant!**

2. Twin Correlations on the Growth Curve Model

(Co)Variance matrix between Intercept & Slope:

1. Phenotypic, within twin co(variances)

	i_1	s_1	i_2	s_2
i_1	v_i			
s_1	r_{is}	v_s		
i_2			v_i	
s_2			r_{is}	v_s



2. Twin Correlations on the Growth Curve Model

(Co)Variance matrix between Intercept & Slope:

2. Cross twin-within trait:

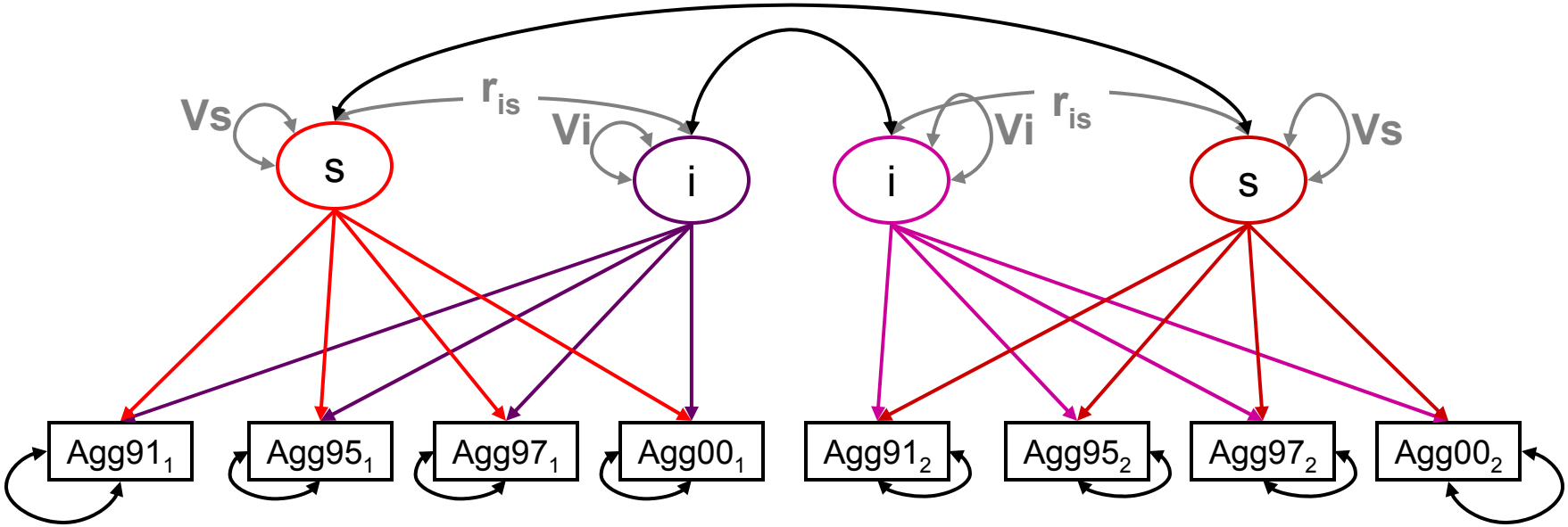
i_1-i_2 & s_1-s_2

MZ

	i_1	s_1	i_2	s_2
i_1	v_i			
s_1	r_{is}	v_s		
i_2	r_{ii}		v_i	
s_2		r_{ss}	r_{is}	v_s

DZ

	i_1	s_1	i_2	s_2
i_1	v_i			
s_1	r_{is}	v_s		
i_2	r_{ii}		v_i	
s_2		r_{ss}	r_{is}	v_s



2. Twin Correlations on the Growth Curve Model

(Co)Variance matrix between Intercept & Slope:

3. Cross twin-cross trait:

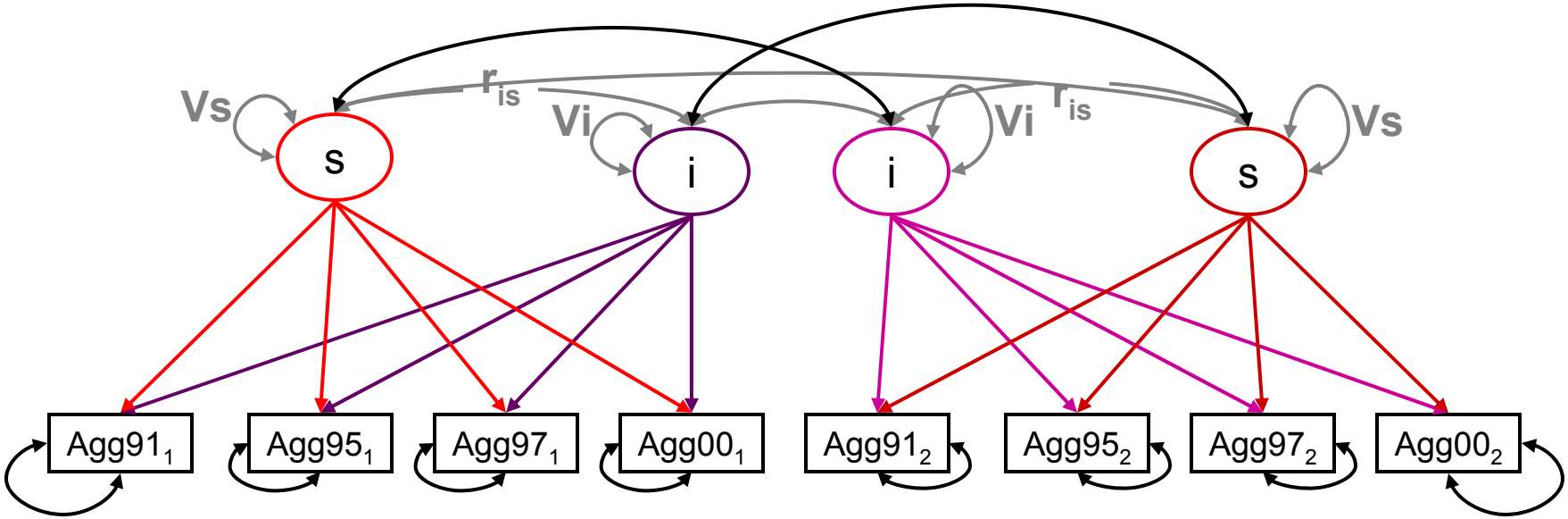
i_1-s_2 & s_1-i_2

MZ

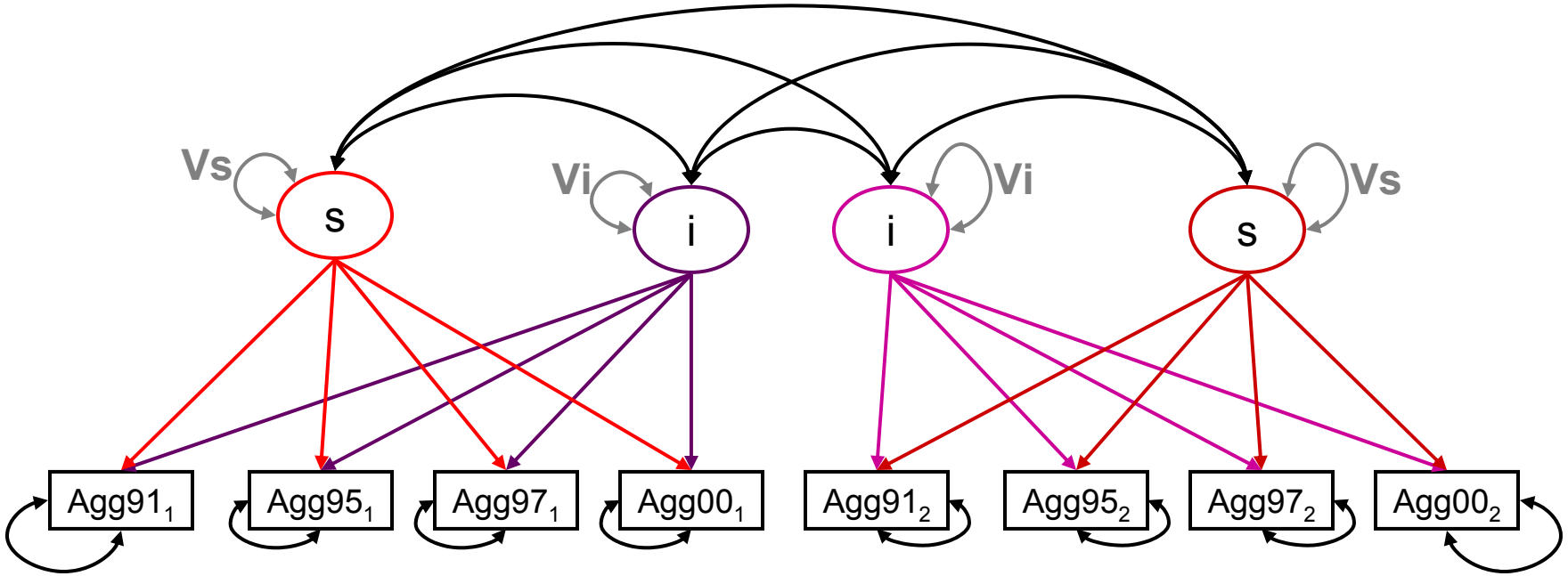
	i_1	s_1	i_2	s_2
i_1	v_i			
s_1	r_{is}	v_s		
i_2	r_{ii}	r_{si}	v_i	
s_2	r_{is}	r_{ss}	r_{is}	v_s

DZ

	i_1	s_1	i_2	s_2
i_1	v_i			
s_1	r_{is}	v_s		
i_2	r_{ii}	r_{si}	v_i	
s_2	r_{is}	r_{ss}	r_{is}	v_s



2. Twin Correlations on the Growth Curve Model



TWLingrow_lib08.mx

RUN

2. Twin Correlations: Matrices (for covariance structure)

COMMON MATRICES

$$F = \begin{bmatrix} 1 & 0 \\ 1 & 2 \\ 1 & 3 \\ 1 & 4.5 \end{bmatrix}$$

$$I \otimes F = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 \\ 1 & 3 & 0 & 0 \\ 1 & 4.5 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 1 & 4.5 \end{bmatrix}$$

$$I = \begin{bmatrix} 1 & \\ & 1 \end{bmatrix}$$

ZYGOSITY SPECIFIC

MZ

$$M = \begin{bmatrix} V_i & & \text{Sym} & \\ r_{is} & V_s & & \\ r_{iiMZ} & r_{isMZ} & V_i & \\ r_{isMZ} & r_{ssMZ} & r_{is} & V_s \end{bmatrix}$$

COVARIANCE (I@F)&M + (I@R) ;

DZ

$$S = \begin{bmatrix} V_i & & \text{Sym} & \\ r_{is} & V_s & & \\ r_{iiDZ} & r_{isDZ} & V_i & \\ r_{isDZ} & r_{ssDZ} & r_{is} & V_s \end{bmatrix}$$

$$R = \begin{bmatrix} e_1 & & & \\ & e_2 & & \\ & & e_3 & \\ & & & e_4 \end{bmatrix}$$

$$I \otimes R = \begin{bmatrix} \text{Residuals Tw1} & & & \\ & & & \\ & & & \text{Residuals Tw2} \\ & & & \\ \text{Uncorrelated Residuals} & & & \end{bmatrix}$$

COVARIANCE (I@F)&S + (I@R) ;

2. Twin Correlations: Script & Output

CORRELATIONS

FOR MODEL SELECTION

MZ

$$M = \begin{bmatrix} V_i & & \text{Sym} \\ r_{is} & V_s & \\ \hline r_{iiMZ} & r_{isMZ} & V_i \\ r_{isMZ} & r_{ssMZ} & r_{is} \quad V_s \end{bmatrix}$$

$$A1 = \backslash stnd(M) = \begin{bmatrix} 1 & & \text{Sym} \\ -.54 & 1 & \\ \hline .55 & -.35 & 1 \\ -.35 & .52 & -.54 \quad 1 \end{bmatrix}$$

DZ

$$S = \begin{bmatrix} V_i & & \text{Sym} \\ r_{is} & V_s & \\ \hline r_{iiDZ} & r_{isDZ} & V_i \\ r_{isDZ} & r_{ssDZ} & r_{is} \quad V_s \end{bmatrix}$$

$$A3 = \backslash stnd(S) = \begin{bmatrix} 1 & & \text{Sym} \\ -.54 & 1 & \\ \hline .52 & -.35 & 1 \\ -.35 & .48 & -.54 \quad 1 \end{bmatrix}$$

2. Twin Correlations: Script & Output

MZ

$$M = \begin{bmatrix} V_i & & \text{Sym} \\ r_{is} & V_s & \\ \hline r_{iiMZ} & r_{isMZ} & V_i \\ r_{isMZ} & r_{ssMZ} & r_{is} \quad V_s \end{bmatrix}$$

COVARIANCES

FOR STARTING VALUES

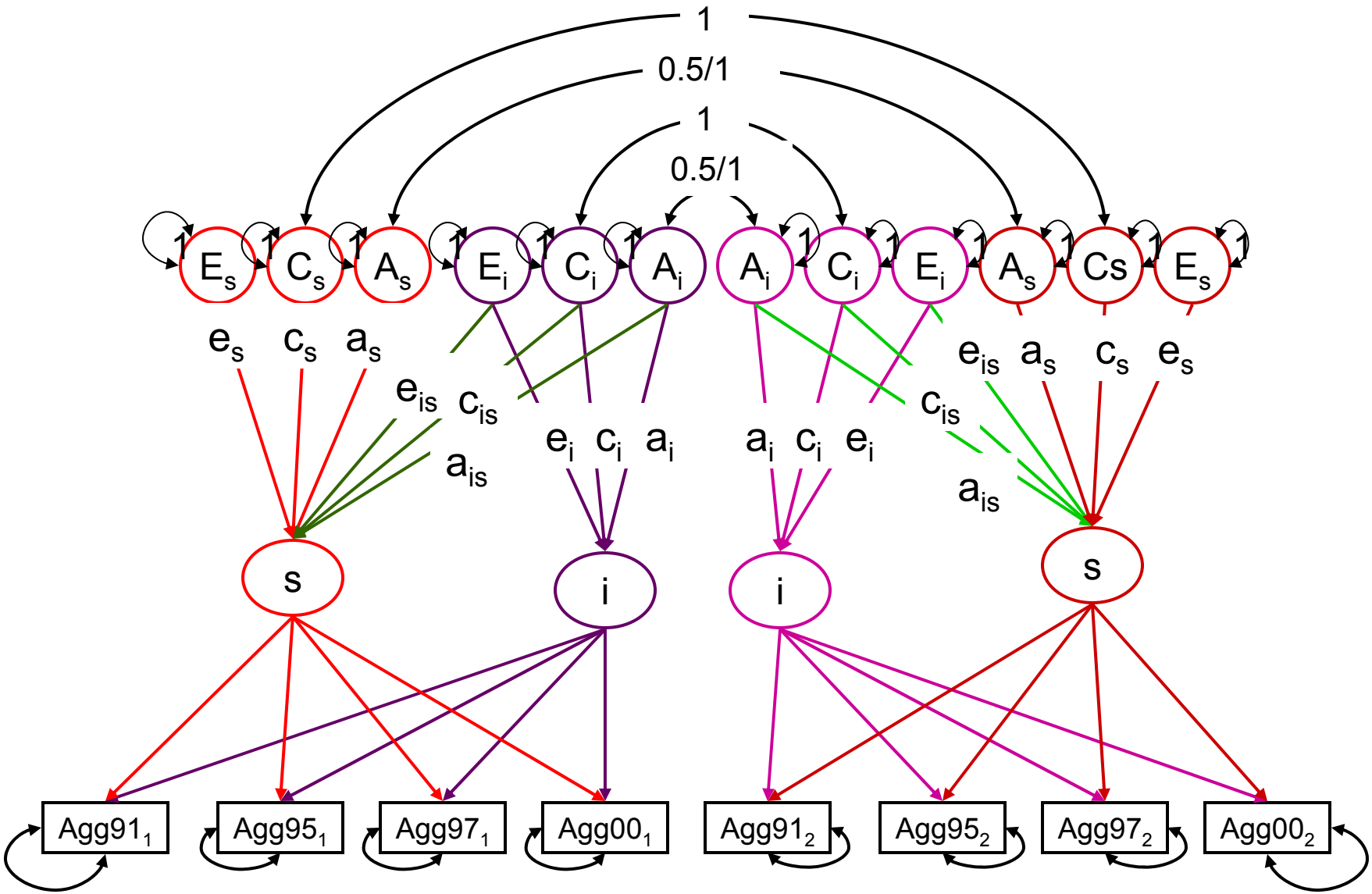
$$M = \begin{bmatrix} 13.05 & & \text{Sym} \\ -1.28 & .43 & \\ \hline 7.21 & -.83 & 13.05 \\ -.83 & .23 & -1.28 \quad .43 \end{bmatrix}$$

DZ

$$S = \begin{bmatrix} V_i & & \text{Sym} \\ r_{is} & V_s & \\ \hline r_{iiDZ} & r_{isDZ} & V_i \\ r_{isDZ} & r_{ssDZ} & r_{is} \quad V_s \end{bmatrix}$$

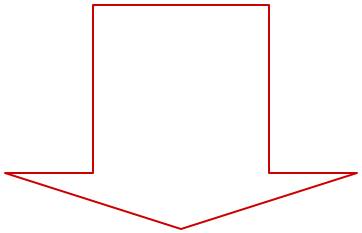
$$S = \begin{bmatrix} 13.05 & & \text{Sym} \\ -1.28 & .43 & \\ \hline 6.80 & -.84 & 13.05 \\ -.84 & .21 & -1.28 \quad .43 \end{bmatrix}$$

3. Genetic Growth Curve Model



3. Genetic Growth Curve Model

Lingrow_lib08.mx



RUN

3. Genetic Growth Curve Model: Matrices

$$X = \begin{bmatrix} a_i & \\ a_{is} & a_s \end{bmatrix} \quad Y = \begin{bmatrix} c_i & \\ c_{is} & c_s \end{bmatrix} \quad Z = \begin{bmatrix} e_i & \\ e_{is} & e_s \end{bmatrix} \quad H = [0.5]$$

$$A = XX' \qquad C = YY' \qquad E = ZZ'$$

MZ

M = A+C+E | A+C _
A+C | A+C+E;

DZ

S = A+C+E | H@A+C _
H@A+C | A+C+E;

COVARIANCE (I@F)&M + (I@R) ;

COVARIANCE (I@F)&S + (I@R) ;

3. Genetic Growth Curve Model: Script & Output

In Matrix K:

	$\%V_i$	$\%V_s$	$\%S_{is}$
A	6	8	0
C	48	44	65
E	45	47	35

Exercise:

Use the option Multiple to Test for genetic effects on:

-Covariance i-s

-Variance I

-Variance S

3. Genetic Growth Curve Model: Model Fitting Results

MODEL	-2LL	DF	vs	χ^2	df	p
FULL	73945.473	13626				
a_{si} =0	73945.473	13627	1	0	1	.986
a_i =0	73946.068	13628	2	.595	1	.440
a_s =0	73947.284	13629	3	1.216	1	.270