

Maternal effect model

**Sire-maternal grandsire model
Animal model with maternal effects**

**Sire-Maternal Grandsire Model
with PE**

$$y = Xb + Zs + Mmgs + Wpe + e$$

```
[X`X X`Z      X`M      X`W      ][b ] [X`y]
[Z`X Z`Z+alpha1#Ai Z`M+alpha12 Z`W      ][u ] [Z`y]
[M`X M`Z+alpha21#Ai M`M+alpha22 M`W      ][m ] [M`y]
[W`X W`Z      W`M      W`W+gamma#I][pe] [W`y]
```

Data Description

Data file:

calf	sex	parity	sire	dam	mgs	bw (kg)
11	1	1	1	4	0	35
12	2	2	1	4	0	20
13	2	1	1	5	0	25
14	1	1	2	6	1	40
15	2	2	3	6	2	42
16	2	3	3	6	2	22

Selected Pedigree file

anim	s	mgs (sire of dam)
1	0	0
2	1	0
3	2	1

$V_s = 5, V_{mgs} = 2, Cov(s, mgs) = 1, V_{pe} = 12, V_e = 40$
 $V_s = 1/4*h^2, V_{mgs} = 1/16*h^2 + 1/4*m^2 + 1/4*Cov(a, m)$
 $V_{pe} = 3/16*h^2 + 3/4*m^2 + 3/4*Cov(a, m) + c^2,$
 $V_e = 1/2*h^2 + e^2$

Start computing

```

PROC IML;
  X = {1 0 1 0 0,   W = {0 0 0 1 0 0,
    0 1 0 1 0,     0 0 0 1 0 0,
    0 1 1 0 0,     0 0 0 0 1 0,
    1 0 1 0 0,     0 0 0 0 0 1,
    0 1 0 1 0,     0 0 0 0 0 1,
    0 1 0 0 1};    0 0 0 0 0 1};

  Z = {1 0 0,
    1 0 0,   y = {35,20,25,40,42,22};
    1 0 0,
    0 1 0,
    0 0 1,   A = { 1 0.5  0.5,
    0 0 1};    0.5  1  0.625,
               0.5 0.625 1};

  M = {0 0 0,
    0 0 0,   Ai = inv(A);
    0 0 0,
    1 0 0,
    0 1 0,   Vgs = 4; Vmgs = 2; Vsmgs = 4; Vpe = 10; Ve = 40;
    0 1 0};

```

```

Vs = 4; Vmgs = 2; Vsmgs = 4; Vpe = 10; Ve = 40;
G = (Vs   || Vsmgs)//
    (Vsmgs || Vmgs );
Gi = INV(G);
alpha = Ve#Gi;
alpha11 = alpha[1,1];
alpha12 = alpha[1,2];
alpha21 = alpha[2,1];
alpha22 = alpha[2,2];
gamma = Ve/Vpe;

```

MME Setup

```

XPX = X`*X;
XPZ = X`*Z;
XPM = X`*M;
XPW = X`*W;
ZPZ = Z`*Z;
ZPM = Z`*M;
ZPW = Z`*W;
MPM = M`*M;
MPW = M`*W;
WPW = W`*W;

ZPZ2 = Z`*Z+alpha11#Ai;
ZPM2 = Z`*M+alpha12#Ai;
MPM2 = M`*M+alpha22#Ai;
WPW2 = W`*W+gamma#I(6);

```

MME Setup

```

lhs = (X`*X || X`*Z          || X`*M          || X`*W          )//
      (Z`*X || Z`*Z+alpha1#Ai || Z`*M+alpha12#Ai || Z`*W          )//
      (M`*X || M`*Z+alpha21#Ai || M`*M+alpha22#Ai || M`*W          )//
      (W`*X || W`*Z          || W`*M          || W`*W+gamma#I(6));

rhs = X`*y // Z`*y // M`*y // W`*y;
sol = GINV(lhs)*rhs;

```

Compute accuracy

```

Di = vecdiag(GINV(lhs));
PEV = Di#Ve;
I = J(17,1,1);
Acc = J(17,1,.);
Acc[6:8,] = SQRT(I[6:8,]-Di[6:8,]#(Ve/Vs));
Acc[9:11,] = SQRT(I[9:11,]-Di[9:11,]#(Ve/Vmgs));
Acc[12:17,] = SQRT(I[12:17,]-Di[12:17,]#gamma);

```

Output

SOL	DI	PEV	ACC	
b1	24.462	1.109	44.355	.
b2	12.323	0.325	13.001	.
b3	12.673	0.567	22.693	.
b4	17.952	0.696	27.839	.
b5	6.161	1.099	43.946	.
s1	0.003	0.099	3.959	0.102
s2	0.930	0.093	3.717	0.266
s3	0.928	0.095	3.787	0.231
mgs1	-0.205	0.050	1.990	0.070
mgs2	0.518	0.047	1.880	0.245
mgs3	0.670	0.047	1.895	0.229
pe1	0.000	0.250	10.000	0.000
pe2	0.000	0.250	10.000	0.000
pe3	0.000	0.250	10.000	0.000
pe4	-2.070	0.211	8.437	0.395
pe5	0.000	0.250	10.000	0.000
pe6	2.070	0.211	8.437	0.395

**Animal Model with Maternal
and PE effects**

$$y = Xb + Zu + Mm + Wp + e$$

```

[X`X X`Z      X`M      X`W      ] [b ] [X`y]
[Z`X Z`Z+alpha1#Ai Z`M+alpha12 Z`W      ] [u ] = [Z`y]
[M`X M`Z+alpha21#Ai M`M+alpha22 M`W      ] [m ] [M`y]
[W`X W`Z      W`M      W`W+gamma#I] [pe] [W`y]
    
```

Data Description

Data file:					Pedigree file:		
calf	dam	hys	sex	bw (kg)	anim	s	d
5	2	1	1	35	1	0	0
6	2	1	2	20	2	0	0
7	6	1	2	25	3	0	0
8	5	1	1	40	4	0	0
9	6	2	1	42	5	1	2
10	2	2	2	22	6	3	2
					7	4	6
					8	3	5
					9	1	6
					10	3	2

Va = 150 Vm = 90 Vam = -40 Vpe = 40 Ve = 350;
