

Online Supplement to:

“Meta-analyses of partial correlations are biased: Detection and solutions”

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Supplement Tables

Table S1: RE_{ss} , RE_z , and $UWLS_{+3}$ meta-analyses of partial correlations

6 IVs: Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_6 X_{6i} + \varepsilon_i$										
Design		Bias			RMSE			Coverage		
ρ	n	RE_{ss}	RE_z	$UWLS_{+3}$	RE_{ss}	RE_z	$UWLS_{+3}$	RE_{ss}	RE_z	$UWLS_{+3}$
.7071	25	-.0017	.0096	.0015	.0161	.0190	.0174	.9940	.9226	.9397
.7071	50	-.0025	.0037	-.0001	.0109	.0115	.0110	.9930	.9428	.9456
.7071	100	-.0017	.0018	-.0001	.0075	.0075	.0074	.9927	.9511	.9510
.7071	200	-.0009	.0009	.0000	.0051	.0051	.0050	.9941	.9542	.9531
.7071	400	-.0005	.0004	-.0001	.0036	.0036	.0036	.9938	.9543	.9480
.3162	25	.0081	.0072	.0003	.0320	.0315	.0307	.9419	.9508	.9367
.3162	50	.0029	.0034	.0002	.0198	.0198	.0195	.9554	.9543	.9458
.3162	100	.0010	.0016	.0001	.0132	.0134	.0133	.9624	.9528	.9469
.3162	200	.0005	.0006	-.0002	.0092	.0091	.0091	.9637	.9575	.9485
.3162	400	.0002	.0003	-.0001	.0064	.0064	.0064	.9635	.9576	.9504
.1104	25	.0033	.0028	.0002	.0350	.0338	.0332	.9370	.9565	.9370
.1104	50	.0008	.0011	-.0002	.0217	.0216	.0214	.9468	.9546	.9441
.1104	100	.0003	.0007	.0001	.0145	.0147	.0146	.9579	.9561	.9469
.1104	200	.0002	.0003	.0000	.0102	.0102	.0102	.9545	.9536	.9438
.1104	400	.0001	.0001	.0000	.0070	.0070	.0070	.9603	.9588	.9505
Average		.0017	.0023	.0002 ^a	.0141	.0143	.0140	.9674	.9518	.9459
10 IVs: Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_{10} X_{10i} + \varepsilon_i$										
.7071	25	.0060	.0119	.0023	.0190	.0225	.0204	.9875	.9104	.9322
.7071	50	-.0015	.0045	.0002	.0111	.0120	.0114	.9957	.9402	.9504
.7071	100	-.0016	.0018	-.0001	.0076	.0077	.0076	.9936	.9507	.9501
.7071	200	-.0009	.0010	.0001	.0052	.0052	.0051	.9939	.9521	.9492
.7071	400	-.0004	.0005	.0000	.0036	.0036	.0036	.9942	.9535	.9485
.3162	25	.0142	.0096	.0014	.0384	.0363	.0350	.9226	.9505	.9351
.3162	50	.0037	.0036	.0001	.0208	.0210	.0206	.9567	.9507	.9429
.3162	100	.0013	.0016	.0000	.0135	.0138	.0136	.9603	.9526	.9466
.3162	200	.0006	.0005	.0000	.0093	.0092	.0092	.9642	.9576	.9485
.3162	400	.0002	.0004	.0000	.0064	.0065	.0065	.9638	.9537	.9479
.1104	25	.0048	.0029	-.0001	.0401	.0384	.0378	.9325	.9588	.9362
.1104	50	.0010	.0012	-.0001	.0228	.0226	.0224	.9498	.9551	.9418
.1104	100	.0007	.0006	.0000	.0148	.0147	.0146	.9527	.9580	.9484
.1104	200	.0001	.0003	.0001	.0102	.0102	.0102	.9586	.9556	.9479
.1104	400	.0001	.0003	.0001	.0072	.0071	.0071	.9549	.9540	.9482
Average		.0025 ^a	.0027	.0002 ^a	.0153	.0154	.0150	.9654	.9502	.9449

Notes: r is the ‘true’ population mean partial correlation coefficient (PCC). n is the sample size used in the primary study’s multiple regression. **Bias** is the difference between the meta-analysis estimate and r calculated from 50 estimated partial correlation coefficients and averaged across 10,000 replications. **RMSE** is the square root of the mean squared error. **Coverage** is the proportion of 10,000 meta-analysis 95% confidence intervals that contain r . RE_1 is the random-effect’s estimate of the mean using S_1^2 , from eq. (3), and $UWLS_{+3}$ is the unrestricted weighted least squares’ estimate of the mean using S_2^2 from eq. (4) and df_{+3} as the degrees of freedom in PCC’s formula. RE_z is the random-effect’s estimate of Fisher’s z converted back to PCC. ^aAverage biases are averages across the absolute values of the biases. Biases reported as ‘.0000’ are $< |\pm|.00005|$.

Table S2: \mathbf{RE}_1 , \mathbf{RE}_z , and \mathbf{UWLS}_{+3} meta-analyses of partial correlations for alternative values of ρ

2 IVs: Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$										
Design		Bias			RMSE			Coverage		
ρ	n	\mathbf{RE}_{ss}	\mathbf{RE}_z	\mathbf{UWLS}_{+3}	\mathbf{RE}_{ss}	\mathbf{RE}_z	\mathbf{UWLS}_{+3}	\mathbf{RE}_{ss}	\mathbf{RE}_z	\mathbf{UWLS}_{+3}
.9487	25	-.0337	.0021	.0004	.0338	.0036	.0032	0.0000	.8991	.9439
.9487	50	-.0165	.0009	.0000	.0166	.0023	.0021	.0053	.9314	.9486
.9487	100	-.0082	.0005	.0000	.0083	.0015	.0015	.6831	.9446	.9512
.9487	200	-.0041	.0002	.0000	.0042	.0010	.0010	.9875	.9502	.9481
.9487	400	-.0020	.0001	.0000	.0021	.0007	.0007	.9994	.9559	.9528
.2425	25	.0037	.0054	.0007	.0288	.0297	.0289	.9544	.9523	.9397
.2425	50	.0019	.0022	-.0001	.0197	.0199	.0196	.9551	.9559	.9460
.2425	100	.0007	.0011	-.0001	.0135	.0138	.0137	.9577	.9556	.9466
.2425	200	.0002	.0004	-.0001	.0094	.0094	.0094	.9635	.9616	.9542
.2425	400	.0003	.0002	-.0001	.0068	.0067	.0067	.9579	.9559	.9484
0	25	-.0001	.0006	.0006	.0309	.0307	.0302	.9458	.9578	.9403
0	50	-.0001	-.0002	-.0002	.0208	.0207	.0205	.9549	.9574	.9472
0	100	-.0003	-.0002	-.0002	.0143	.0143	.0142	.9581	.9593	.9505
0	200	.0000	.0000	.0000	.0101	.0102	.0102	.9572	.9545	.9456
0	400	-.0001	.0002	.0002	.0071	.0071	.0071	.9558	.9567	.9503
Average		.0048 ^a	.0010 ^a	.0002 ^a	.0151	.0114	.0113	.8157	.9499	.9476
4 IVs: Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \varepsilon_i$										
.9487	25	.0131	.0023	.0005	.0333	.0038	.0022	0.0000	.8971	.9439
.9487	50	.0062	.0010	.0000	.0166	.0023	.0015	.0129	.9303	.9506
.9487	100	.0030	.0005	.0000	.0083	.0015	.0010	.7110	.9446	.9500
.9487	200	.0015	.0002	.0000	.0042	.0010	.0007	.9863	.9508	.9495
.9487	400	.0007	.0001	.0000	.0021	.0007	.0302	.9996	.9536	.9505
.2425	25	.0298	.0061	.0010	.0312	.0310	.0200	.9444	.9540	.9399
.2425	50	.0149	.0026	.0001	.0203	.0203	.0137	.9519	.9544	.9436
.2425	100	.0074	.0010	-.0003	.0137	.0138	.0095	.9603	.9543	.9465
.2425	200	.0038	.0006	.0000	.0096	.0095	.0067	.9607	.9602	.9516
.2425	400	.0018	.0003	.0000	.0067	.0068	.0318	.9566	.9545	.9469
0	25	.0000	.0003	.0003	.0323	.0323	.0212	.9465	.9564	.9379
0	50	.0000	.0000	.0000	.0213	.0214	.0146	.9521	.9557	.9450
0	100	.0001	.0001	.0001	.0146	.0147	.0101	.9531	.9552	.9458
0	200	.0000	.0000	.0000	.0101	.0102	.0072	.9590	.9549	.9472
0	400	.0000	.0000	.0000	.0070	.0072	.0022	.9575	.9553	.9478
Average		.0055 ^a	.0010 ^a	.0002 ^a	.0154	.0118	.0116	.8168	.9488	.9464

Notes: r is the ‘true’ population mean partial correlation coefficient (PCC). n is the sample size used in the primary study’s multiple regression. **Bias** is the difference between the meta-analysis estimate and ρ calculated from 50 estimated partial correlation coefficients and averaged across 10,000 replications. **RMSE** is the square root of the mean squared error. **Coverage** is the proportion of 10,000 meta-analysis 95% confidence intervals that contain ρ . \mathbf{RE}_1 is the random-effect’s estimate of the mean using S_1^2 , from eq. (3), and \mathbf{UWLS}_{+3} is the unrestricted weighted least squares’ estimate of the mean using S_2^2 from eq. (4) and df_{+3} as the degrees of freedom in PCC’s formula. \mathbf{RE}_z is the random-effect’s estimate of Fisher’s z converted back to PCC. Biases reported as ‘.0000’ are $< |\pm .00005|$. ^aAverage biases are averages across the absolute values of the biases.

Table S3: RE_{ss} , RE_z , and $UWLS_{+3}$ meta-analyses of partial correlations for alternative number of studies (k)

k=10; Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$										
Design		Bias			RMSE			Coverage		
ρ	n	RE_{ss}	RE_z	$UWLS_{+3}$	RE_{ss}	RE_z	$UWLS_{+3}$	RE_{ss}	RE_z	$UWLS_{+3}$
.7071	25	-.0101	.0061	-.0021	.0339	.0342	.0349	.9946	.9572	.9444
.7071	50	-.0048	.0030	-.0012	.0228	.0231	.0234	.9942	.9595	.9501
.7071	100	-.0026	.0016	-.0005	.0162	.0162	.0163	.9944	.9584	.9469
.7071	200	-.0010	.0007	-.0004	.0113	.0114	.0115	.9937	.9592	.9487
.7071	400	-.0007	.0003	-.0002	.0079	.0079	.0079	.9949	.9615	.9510
.3162	25	.0013	.0046	-.0023	.0607	.0618	.0611	.9605	.9611	.9444
.3162	50	.0003	.0031	-.0004	.0420	.0422	.0418	.9632	.9587	.9462
.3162	100	.0000	.0005	-.0012	.0290	.0288	.0288	.9670	.9607	.9506
.3162	200	.0000	.0003	-.0005	.0205	.0201	.0201	.9633	.9626	.9528
.3162	400	.0000	.0006	.0002	.0144	.0143	.0143	.9636	.9599	.9466
.1104	25	-.0005	.0025	-.0002	.0675	.0677	.0664	.9527	.9617	.9463
.1104	50	.0005	.0012	-.0002	.0455	.0458	.0453	.9582	.9595	.9464
.1104	100	-.0003	.0008	.0002	.0319	.0323	.0321	.9580	.9564	.9446
.1104	200	-.0001	.0003	.0000	.0227	.0224	.0224	.9567	.9619	.9482
.1104	400	-.0001	-.0001	-.0003	.0156	.0157	.0156	.9604	.9605	.9491
Average		.0015	.0017	.0002 ^a	.0295	.0296	.0295	.9717	.9599	.9478
k=200; Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$										
.7071	25	-.0066	.0080	.0013	.0099	.0109	.0079	.7071	.9675	.8230
.7071	50	-.0034	.0036	.0001	.0061	.0063	.0053	.7071	.9800	.8964
.7071	100	-.0018	.0018	.0000	.0040	.0040	.0036	.7071	.9896	.9239
.7071	200	-.0009	.0008	-.0001	.0027	.0027	.0025	.7071	.9911	.9399
.7071	400	-.0005	.0004	.0000	.0018	.0018	.0018	.7071	.9921	.9479
.3162	25	.0060	.0065	.0008	.0149	.0151	.0137	.3162	.9328	.9316
.3162	50	.0025	.0032	.0003	.0096	.0100	.0094	.3162	.9528	.9387
.3162	100	.0012	.0014	.0000	.0067	.0067	.0065	.3162	.9538	.9481
.3162	200	.0005	.0007	.0000	.0046	.0046	.0046	.3162	.9607	.9509
.3162	400	.0002	.0003	.0000	.0032	.0032	.0032	.3162	.9654	.9547
.1104	25	.0024	.0025	.0003	.0156	.0154	.0150	.1104	.9370	.9528
.1104	50	.0010	.0010	-.0001	.0103	.0103	.0101	.1104	.9490	.9538
.1104	100	.0005	.0006	.0001	.0072	.0072	.0071	.1104	.9520	.9521
.1104	200	.0002	.0002	-.0001	.0050	.0049	.0049	.1104	.9553	.9556
.1104	400	.0001	.0001	.0000	.0035	.0035	.0035	.1104	.9563	.9543
Average		.0019 ^a	.0021	.0002 ^a	.0137	.0138	.0135	.9681	.9531	.9470

Notes: ρ is the ‘true’ population mean partial correlation coefficient (PCC). n is the sample size used in the primary study’s multiple regression. **Bias** is the difference between the meta-analysis estimate and ρ calculated from 50 estimated partial correlation coefficients and averaged across 10,000 replications. **RMSE** is the square root of the mean squared error. **Coverage** is the proportion of 10,000 meta-analysis 95% confidence intervals that contain ρ . RE_{ss} is the random-effect’s estimate of the mean using S_2^2 , from eq. (3) and the small-sample adjustment $(n-2)/(n-1)$. $UWLS_{+3}$ is the unrestricted weighted least squares’ estimate of the mean using S_2^2 from eq. (4) and df_{+3} as the degrees of freedom in PCC’s formula. RE_z is the random-effect’s estimate of Fisher’s z converted back to PCC. ^aAverage biases are averages across the absolute values of the biases. Biases reported as ‘.0000’ are $< |\pm.00005|$.

Table S4: RE_{ss} , RE_z , and $UWLS_{+3}$ with heterogeneity and for alternative number of studies (k)

k=10; Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$										
Design		Bias			RMSE			Coverage		
ρ	I^2	RE_{ss}	RE_z	$UWLS_{+3}$	RE_{ss}	RE_z	$UWLS_{+3}$	RE_{ss}	RE_z	$UWLS_{+3}$
.7071	.307	-.0131	.0001	-.0002	.0467	.0454	.0456	.9704	.9224	.9421
.7071	.479	-.0111	-.0035	.0009	.0403	.0376	.0369	.9482	.9174	.9460
.7071	.671	-.0123	-.0057	.0014	.0379	.0337	.0325	.9121	.9096	.9452
.7071	.813	-.0145	-.0056	.0027	.0363	.0316	.0303	.8978	.9066	.9444
.7071	.899	-.0153	-.0061	.0027	.0354	.0305	.0290	.8923	.9071	.9436
.3162	.328	-.0049	.0026	-.0006	.0722	.0722	.0731	.9345	.9428	.9432
.3162	.430	-.0057	-.0003	.0005	.0577	.0572	.0580	.9249	.9213	.9429
.3162	.595	-.0068	-.0028	-.0001	.0490	.0491	.0497	.9165	.9154	.9488
.3162	.750	-.0079	-.0024	.0014	.0454	.0447	.0452	.9084	.9081	.9473
.3162	.860	-.0079	-.0033	.0009	.0431	.0431	.0434	.9053	.9030	.9437
.1104	.264	-.0012	.0013	-.0008	.0733	.0742	.0740	.9391	.9460	.9365
.1104	.303	-.0014	-.0001	-.0006	.0542	.0554	.0557	.9340	.9335	.9398
.1104	.424	-.0014	-.0006	-.0004	.0440	.0439	.0443	.9209	.9240	.9441
.1104	.591	-.0009	.0002	.0008	.0374	.0381	.0385	.9123	.9159	.9486
.1104	.744	-.0016	-.0009	-.0001	.0345	.0346	.0349	.9053	.9056	.9440
Average		.0071 ^a	.0024 ^a	.0009	.0472	.0461	.0461	.9215	.9186	.9440
k=200; Partial Correlation of X_1 from $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$										
.7071	.395	-.0035	.0027	.0048	.0097	.0102	.0110	.9593	.9400	.9208
.7071	.576	-.0060	-.0017	.0045	.0110	.0084	.0092	.8522	.9467	.9169
.7071	.740	-.0112	-.0038	.0045	.0139	.0084	.0085	.6548	.9208	.9031
.7071	.854	-.0138	-.0046	.0048	.0157	.0083	.0082	.4721	.9014	.8907
.7071	.922	-.0152	-.0050	.0049	.0168	.0084	.0081	.3683	.8809	.8845
.3162	.432	-.0003	.0038	.0023	.0167	.0167	.0167	.9300	.9422	.9361
.3162	.535	-.0047	.0005	.0024	.0139	.0130	.0134	.9267	.9449	.9388
.3162	.682	-.0068	-.0014	.0022	.0129	.0111	.0114	.9093	.9455	.9412
.3162	.808	-.0073	-.0020	.0025	.0124	.0102	.0104	.8901	.9463	.9401
.3162	.893	-.0078	-.0025	.0024	.0122	.0099	.0100	.8760	.9399	.9403
.1104	.350	.0012	.0017	.0003	.0165	.0166	.0166	.9402	.9490	.9396
.1104	.388	-.0006	.0008	.0006	.0124	.0124	.0125	.9417	.9479	.9432
.1104	.516	-.0009	.0001	.0005	.0099	.0098	.0099	.9475	.9510	.9491
.1104	.673	-.0013	-.0003	.0005	.0085	.0086	.0087	.9485	.9466	.9449
.1104	.802	-.0013	-.0003	.0006	.0078	.0077	.0078	.9458	.9486	.9480
Average		.0055 ^a	.0021 ^a	.0025	.0127	.0106	.0108	.8375	.9368	.9292

Notes: ρ is the ‘true’ population mean partial correlation coefficient (PCC). The sample sizes of the primary study’s multiple regressions are the same as reported in Tables 1 and 2. **Bias** is the difference between the meta-analysis estimate and ρ calculated from 50 estimated partial correlation coefficients and averaged across 10,000 replications. **RMSE** is the square root of the mean squared error. **Coverage** is the proportion of 10,000 meta-analysis 95% confidence intervals that contain ρ . RE_{ss} is the random-effect’s estimate of the mean using S^2_{ρ} , from eq. (4) and the small-sample adjustment $(n-2)/(n-1)$. $UWLS_{+3}$ is the unrestricted weighted least squares’ estimate of the mean using S^2_{ρ} from eq. (4) and df_{+3} as the degrees of freedom in PCC’s formulae. RE_z is the random-effect’s estimate of Fisher’s z converted back to PCC. ^aAverage biases are averages across the absolute values of the biases. Biases reported as ‘.0000’ are $< |\pm.00005|$.

GAUSS code for simulations reported in Table 1

```

/*****
/* PROGRAM: Part Corr MAs using both formulas for SEpcc */
/* AUTHOR: Tom Stanley */
/* 10:03 AM 01-Feb-2023 */
/*****
new;
screen off;
rep=10000;/* the number of replications*/
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={ }; Seinv2={ };Seinv3={ };
  t1={ }; t2={ };t3={ };b2={ };
  W1i={ };
  Ssq1={ };
  W2i={ };
  Ssq2={ };
  j=1;
  do while (j<=k);
    X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,sth,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
    t1i=pcc/SErob;Seinv1i=1/SErob;
    t2i=pcc/SEbook;Seinv2i=1/SEbook;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    b2=b2|pcc;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;
    Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
    j=j+1;
  endo;
rr=k;
z1=ones(rr,1);
ave=b2'*z1/rr; sum3=sum3+ave;
sumW1=W1i'*z1;sumW2=W2i'*z1;

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```

/* The below program calculates the unrestricted WLS2 & UWLS1 */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.5))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
    if LL1<=sqrt(.5) and UL1>=sqrt(.5);
        cov3=cov3+1;
    endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.5))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1)); /*Eq (5.5)*/
Q=(W1i'b2^2)-(b2*W1i)^2/sumW1; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]); /*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        cov1=cov1+1;
    endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.5))^2;
Wave2=sumW2/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2)); /*Eq (5.5)*/
Q=(W2i'b2^2)-(b2*W2i)^2/sumW2; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq2[iBS]); /*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        cov2=cov2+1;
    endif;

```

```

endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(.5);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.5);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.5);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.5);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.5);
screen on;
"RE & UWLS both Var's;k=50;n={25,50,...,400} 2 IVs,10kReps, True PCC=sqrt(.5)";
"Average bias, REBias1 SE'rob', REBias2 SE'book', UWLS1Bias,UWLS2bias,Coverages, MSEs";
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={ }; Seinv2={ };Seinv3={ };
t1={ }; t2={ };t3={ };b2={ };
W1i={ };
Ssq1={ };
W2i={ };
Ssq2={ };
j=1;
do while (j<=k);
X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,spb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
t1i=pcc/SErob;Seinv1i=1/SErob;
t2i=pcc/SEbook;Seinv2i=1/SEbook;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
b2=b2|pcc;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;
Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.5))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
if LL1<=sqrt(.5) and UL1>=sqrt(.5);

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        cov3=cov3+1;
    endif;
bb2=inv(Seinv1'*Seinv1)*Seinv1't1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1'*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.5))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-r*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        cov1=cov1+1;
    endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.5))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-r*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        cov2=cov2+1;
    endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
    endo;
UWLSBias1=(sum1/rep)-sqrt(.5);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.5);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.5);REcov1=cov1/rep;

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REBias2=(sum7/rep)-sqrt(.5);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.5);
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={}; Seinv2={};Seinv3={};
  t1={}; t2={};t3={};b2={};
  W1i={};
  Ssq1={};
  W2i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,spb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
    t1i=pcc/SErob;Seinv1i=1/SErob;
    t2i=pcc/SEbook;Seinv2i=1/SEbook;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    b2=b2|pcc;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;
    Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
    j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.5))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
  if LL1<=sqrt(.5) and UL1>=sqrt(.5);
    cov3=cov3+1;
  endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.5))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(.5) and UL2>=sqrt(.5);
    cov4=cov4+1;

```

```

endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
cov1=cov1+1;
endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.5))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
cov2=cov2+1;
endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(.5);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.5);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.5);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.5);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.5);
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;

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sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={ }; Seinv2={ };Seinv3={ };
t1={ }; t2={ };t3={ };b2={ };
W1i={ };
Ssq1={ };
W2i={ };
Ssq2={ };
j=1;
do while (j<=k);
X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
t1i=pcc/SErob;Seinv1i=1/SErob;
t2i=pcc/SEbook;Seinv2i=1/SEbook;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
b2=b2|pcc;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;
Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
j=j+1;
enddo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)'*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.5))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
if LL1<=sqrt(.5) and UL1>=sqrt(.5);
cov3=cov3+1;
endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)'*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.5))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(.5) and UL2>=sqrt(.5);
cov4=cov4+1;
endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;

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endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(b2'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
cov1=cov1+1;
endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.5))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2'*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2'*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
cov2=cov2+1;
endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(.5);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.5);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.5);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.5);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.5);
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={ }; Seinv2={ };Seinv3={ };
t1={ }; t2={ };t3={ };b2={ };
W1i={ };
Ssq1={ };
W2i={ };

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Ssq2={ };
j=1;
do while (j<=k);
    X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
    t1i=pcc/SErob;Seinv1i=1/SErob;
    t2i=pcc/SEbook;Seinv2i=1/SEbook;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    b2=b2|pcc;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;
    Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
    j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.5))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
    if LL1<=sqrt(.5) and UL1>=sqrt(.5);
        cov3=cov3+1;
    endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.5))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/

```

```

VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
cov1=cov1+1;
endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.5))^2;
Wave2=sumW2/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2)); /*Eq (5.5)*/
Q=(W2i*b2^2)-(b2*W2i)^2/sumW2; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq2[iBS]); /*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
cov2=cov2+1;
endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(.5);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.5);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.5);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.5);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.5);
screen on;
n;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
do while (kk<=rep); /* the number of replications*/
Seinv1={ }; Seinv2={ };Seinv3={ };
t1={ }; t2={ };t3={ };b2={ };
W1i={ };
Ssq1={ };
W2i={ };
Ssq2={ };
j=1;
do while (j<=k);
X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;

```

```

        { nam,m,b,spb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
        ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
        t1i=pcc/SErob;Seinv1i=1/SErob;
        t2i=pcc/SEbook;Seinv2i=1/SEbook;
        Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
        Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
        b2=b2|pcc;
        W1ii=Seinv1i^2;
        W2ii=Seinv2i^2;
        W1i=W1i|W1ii;W2i=W2i|W2ii;
        Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEbook^2;
        j=j+1;
        endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)'*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.1))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
        if LL1<=sqrt(.1) and UL1>=sqrt(.1);
                cov3=cov3+1;
        endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)'*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.1))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
        if LL2<=sqrt(.1) and UL2>=sqrt(.1);
                cov4=cov4+1;
        endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
        if Q<=rr-1;
                BSvar=0;
        endif;
iBS=1; weight={ };
        do while (iBS<=rr);
                weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
                weight=weight|weighti;
                iBS=iBS+1;
        endo;
sumWeight1=weight*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
        if llr<=sqrt(.1) and ulr>=sqrt(.1);
                cov1=cov1+1;
        endif;
        sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.1))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/

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U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2'*W2i)^2/sumW2; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq2[iBS]); /*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        cov2=cov2+1;
    endif;
    sum7=sum7+REWA2; MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(.1); UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.1); UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.1); REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.1); REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5; WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5; RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.1);
screen on;
"RE &UWLS both Var's;k=50;n={25,50,...,400} 2 IVs,10kReps,True PCC=sqrt(.1)";
"Average bias, REBias1 SE'rob', REBias2 SE'book', UWLS1Bias,UWLS2bias,Coverages, MSEs";
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
    do while (kk<=rep); /* the number of replications*/
        Seinv1={ }; Seinv2={ }; Seinv3={ };
        t1={ }; t2={ }; t3={ }; b2={ };
        W1i={ };
        Ssq1={ };
        W2i={ };
        Ssq2={ };
        j=1;
        do while (j<=k);
            X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
            X1=ones(n,1);
            Y=X1+X2+X3+rndn(n,1);
            X=X2~X3;
            _olsres=1;
            { nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
            ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
            t1i=pcc/SErob;Seinv1i=1/SErob;
            t2i=pcc/SEbook;Seinv2i=1/SEbook;
            Seinv1=Seinv1|Seinv1i;t1=t1|t1i;

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        Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
        b2=b2|pcc;
        W1ii=Seinv1i^2;
        W2ii=Seinv2i^2;
        W1i=W1i|W1ii;W2i=W2i|W2ii;
        Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
        j=j+1;
        endo;
    rr=k;
    z1=ones(rr,1);
    ave=b2*z1/rr; sum3=sum3+ave;
    sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
    bb1=inv(Seinv2*Seinv2)*Seinv2't2;sum1=sum1+bb1;
    s2wls=(t2-Seinv2*bb1)'*(t2-Seinv2*bb1)/(rr-1);
    WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.1))^2;
    UL1=bb1[1]+2.01*sqrt(WLSVAR1);
    LL1=bb1[1]-2.01*sqrt(WLSVAR1);
        if LL1<=sqrt(.1) and UL1>=sqrt(.1);
            cov3=cov3+1;
        endif;
    bb2=inv(Seinv1*Seinv1)*Seinv1't1;sum2=sum2+bb2;
    s2wls2=(t1-Seinv1*bb2)'*(t1-Seinv1*bb2)/(rr-1);
    WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.1))^2;
    UL2=bb2[1]+2.01*sqrt(WLSVAR2);
    LL2=bb2[1]-2.01*sqrt(WLSVAR2);
        if LL2<=sqrt(.1) and UL2>=sqrt(.1);
            cov4=cov4+1;
        endif;
/* The below program calculates RE */
    Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
    S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
    U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
    Q=(W1i'b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
    BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
        if Q<=rr-1;
            BSvar=0;
        endif;
    iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
    sumWeight1=weight*z1;
    REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
    VARRE=1/sumWeight1;
    ulr=REWA1+1.96*sqrt(VARRE);
    llr=REWA1-1.96*sqrt(VARRE);
        if llr<=sqrt(.1) and ulr>=sqrt(.1);
            cov1=cov1+1;
        endif;
    sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.1))^2;
    Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
    S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
    U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
    Q=(W2i'b2^2)-(b2*W2i)^2/sumW2;/*Eq (3.2)*/
    BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
        if Q<=rr-1;
            BSvar=0;
        endif;
    iBS=1; weight={ };

```

```

do while (iBS<=rr);
weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight^*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.1) and ulr>=sqrt(.1);
cov2=cov2+1;
endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(.1);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.1);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.1);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.1);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.1);
screen on;
n;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={ }; Seinv2={ };Seinv3={ };
t1={ }; t2={ };t3={ };b2={ };
W1i={ };
Ssq1={ };
W2i={ };
Ssq2={ };
j=1;
do while (j<=k);
X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
t1i=pcc/SErob;Seinv1i=1/SErob;
t2i=pcc/SEbook;Seinv2i=1/SEbook;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
b2=b2|pcc;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;
Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
j=j+1;
endo;
rr=k;

```

```

z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.1))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
    if LL1<=sqrt(.1) and UL1>=sqrt(.1);
        cov3=cov3+1;
    endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.1))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.1) and UL2>=sqrt(.1);
        cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        cov1=cov1+1;
    endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.1))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i*b2^2)-(b2*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);

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```

llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(.1) and ulr>=sqrt(.1);
  cov2=cov2+1;
  endif;
  sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
  endo;
UWLSBias1=(sum1/rep)-sqrt(.1);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.1);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.1);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.1);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.1);
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
  do while (kk<=rep);/* the number of replications*/
  Sein1={ }; Sein2={ };Sein3={ };
  t1={ }; t2={ };t3={ };b2={ };
  W1i={ };
  Ssq1={ };
  W2i={ };
  Ssq2={ };
  j=1;
  do while (j<=k);
  X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
  X1=ones(n,1);
  Y=X1+X2+X3+rndn(n,1);
  X=X2~X3;
  _olsres=1;
  { nam,m,b,sth,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
  ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
  t1i=pcc/SErob;Sein1i=1/SErob;
  t2i=pcc/SEBook;Sein2i=1/SEBook;
  Sein1=Sein1|Sein1i;t1=t1|t1i;
  Sein2=Sein2|Sein2i;t2=t2|t2i;
  b2=b2|pcc;
  W1ii=Sein1i^2;
  W2ii=Sein2i^2;
  W1i=W1i|W1ii;W2i=W2i|W2ii;
  Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
  j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Sein2*Sein2)*Sein2't2;sum1=sum1+bb1;
s2wls=(t2-Sein2*bb1)'*(t2-Sein2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Sein1*Sein1);MSE3=MSE3+(bb1[1]-sqrt(.1))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);

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        if LL1<=sqrt(.1) and UL1>=sqrt(.1);
        cov3=cov3+1;
        endif;
bb2=inv(Seinv1*Seinv1)*Seinv1't1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.1))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
        if LL2<=sqrt(.1) and UL2>=sqrt(.1);
        cov4=cov4+1;
        endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'b2^2)-(b2'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
        if Q<=rr-1;
        BSvar=0;
        endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(b2'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
        if llr<=sqrt(.1) and ulr>=sqrt(.1);
        cov1=cov1+1;
        endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.1))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2'*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
        if Q<=rr-1;
        BSvar=0;
        endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
        if llr<=sqrt(.1) and ulr>=sqrt(.1);
        cov2=cov2+1;
        endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(.1);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.1);UWLScov2=cov4/rep;

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REBias1=(sum5/rep)-sqrt(.1);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.1);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.1);
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={ }; Seinv2={ };Seinv3={ };
  t1={ }; t2={ };t3={ };b2={ };
  W1i={ };
  Ssq1={ };
  W2i={ };
  Ssq2={ };
  j=1;
  do while (j<=k);
    X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
    t1i=pcc/SErob;Seinv1i=1/SErob;
    t2i=pcc/SEbook;Seinv2i=1/SEbook;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    b2=b2|pcc;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;
    Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
    j=j+1;
  endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(.1))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
  if LL1<=sqrt(.1) and UL1>=sqrt(.1);
    cov3=cov3+1;
  endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(.1))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(.1) and UL2>=sqrt(.1);

```

```

        cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        cov1=cov1+1;
    endif;
    sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(.1))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        cov2=cov2+1;
    endif;
    sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
    endo;
UWLSBias1=(sum1/rep)-sqrt(.1);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(.1);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(.1);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(.1);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(.1);
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;

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sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={}; Seinv2={};Seinv3={};
  t1={}; t2={};t3={ };b2={};
  W1i={};
  Ssq1={};
  W2i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,spb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
    t1i=pcc/SErob;Seinv1i=1/SErob;
    t2i=pcc/SEbook;Seinv2i=1/SEbook;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    b2=b2|pcc;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;
    Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
    j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)'*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(1/82))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
  if LL1<=sqrt(1/82) and UL1>=sqrt(1/82);
    cov3=cov3+1;
  endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)'*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(1/82))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
    cov4=cov4+1;
  endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;

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    BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(b2'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        cov1=cov1+1;
    endif;
    sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(1/82))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2'*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2'*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        cov2=cov2+1;
    endif;
    sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
    endo;
UWLSBias1=(sum1/rep)-sqrt(1/82);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(1/82);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(1/82);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(1/82);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(1/82);UWLScov1=cov3/rep;
screen on;
"RE &UWLS both Var's;k=50;n={25,50,...,400} 2 IVs,10kReps,True PCC=sqrt(1/82)";
"Average bias, REBias1 SE'rob', REBias2 SE'book', UWLS2Bias,UWLSnbias,Coverages";
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
    do while (kk<=rep);/* the number of replications*/
        Seinv1={ }; Seinv2={ };Seinv3={ };
        t1={ }; t2={ };t3={ };b2={ };

```

```

W1i={ };
Ssq1={ };
W2i={ };
Ssq2={ };
j=1;
do while (j<=k);
    X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
    t1i=pcc/SErob;Seinv1i=1/SErob;
    t2i=pcc/SEbook;Seinv2i=1/SEbook;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    b2=b2|pcc;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;
    Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
    j=j+1;
enddo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(1/82))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
    if LL1<=sqrt(1/82) and UL1>=sqrt(1/82);
    cov3=cov3+1;
    endif;
bb2=inv(Seinv1*Seinv1*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(1/82))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
    cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*b^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
    BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;

```

```

    endo;
    sumWeight1=weight'*z1;
    REWA1=(b2'*weight)/sumWeight1; /*Eq(5.8)*/
    VARRE=1/sumWeight1;
    ulr=REWA1+1.96*sqrt(VARRE);
    llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    cov1=cov1+1;
    endif;
    sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(1/82))^2;
Wave2=sumW2/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2'*z1-rr*Wave2^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2)); /*Eq (5.5)*/
Q=(W2i'b2^2)-(b2'*W2i)^2/sumW2; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
    BSvar=0;
    endif;
    iBS=1; weight={ };
    do while (iBS<=rr);
    weighti=1/(BSvar+Ssq2[iBS]); /*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;
    sumWeight2=weight'*z1;
    REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
    VARRE2=1/sumWeight2;
    ulr=REWA2+1.96*sqrt(VARRE2);
    llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    cov2=cov2+1;
    endif;
    sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(1/82))^2;
    kk=kk+1;
    endo;
UWLSBias1=(sum1/rep)-sqrt(1/82);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(1/82);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(1/82);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(1/82);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(1/82);UWLScov1=cov3/rep;
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep); /* the number of replications*/
    Seinv1={ }; Seinv2={ };Seinv3={ };
    t1={ }; t2={ };t3={ };b2={ };
    W1i={ };
    Ssq1={ };
    W2i={ };
    Ssq2={ };
    j=1;
    do while (j<=k);
        X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
        X1=ones(n,1);

```

```

Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,sth,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
t1i=pcc/SErob;Seinv1i=1/SErob;
t2i=pcc/SEbook;Seinv2i=1/SEbook;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
b2=b2|pcc;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;
Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEbook^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2'*Seinv2)*Seinv2't2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1'*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(1/82))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
if LL1<=sqrt(1/82) and UL1>=sqrt(1/82);
cov3=cov3+1;
endif;
bb2=inv(Seinv1'*Seinv1)*Seinv1't1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1'*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(1/82))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
cov4=cov4+1;
endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'b2^2)-(b2'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(b2'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
cov1=cov1+1;
endif;

```

```

sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(1/82))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i*b2^2)-(b2*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
cov2=cov2+1;
endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(1/82);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(1/82);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(1/82);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(1/82);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(1/82);UWLScov1=cov3/rep;
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={ }; Seinv2={ };Seinv3={ };
t1={ }; t2={ };t3={ };b2={ };
W1i={ };
Ssq1={ };
W2i={ };
Ssq2={ };
j=1;
do while (j<=k);
X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,sth,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
t1i=pcc/SErob;Seinv1i=1/SErob;
t2i=pcc/SEbook;Seinv2i=1/SEbook;

```

```

    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    b2=b2|pcc;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;
    Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
    j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2't2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(1/82))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
    if LL1<=sqrt(1/82) and UL1>=sqrt(1/82);
        cov3=cov3+1;
    endif;
bb2=inv(Seinv1*Seinv1)*Seinv1't1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(1/82))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
        cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'b2^2)-(b2*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
enddo;
sumWeight1=weight*z1;
REWA1=(b2*weight)/sumWeight1;/*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        cov1=cov1+1;
    endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(1/82))^2;
Wave2=sumW2/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-rr*Wave2^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2));/*Eq (5.5)*/
Q=(W2i'b2^2)-(b2*W2i)^2/sumW2;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;

```

```

iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq2[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
cov2=cov2+1;
endif;
sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(1/82);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(1/82);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(1/82);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(1/82);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(1/82);UWLScov1=cov3/rep;
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={ }; Seinv2={ };Seinv3={ };
t1={ }; t2={ };t3={ };b2={ };
W1i={ };
Ssq1={ };
W2i={ };
Ssq2={ };
j=1;
do while (j<=k);
X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,spb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=b[2]/std[2];pcpart=ti^2+n-3;pcc=ti/sqrt(pcpart);
SEBook=sqrt((1-pcc^2)/(n-3));
SErob=(1-pcc^2)/sqrt((n-3));
t1i=pcc/SErob;Seinv1i=1/SErob;
t2i=pcc/SEbook;Seinv2i=1/SEbook;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
b2=b2|pcc;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;
Ssq1=Ssq1|SErob^2;Ssq2=Ssq2|SEBook^2;
j=j+1;
endo;

```

```

rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
/* The below program calculates the unrestricted WLS & UWLS with n */
bb1=inv(Seinv2*Seinv2)*Seinv2*t2;sum1=sum1+bb1;
s2wls=(t2-Seinv2*bb1)*(t2-Seinv2*bb1)/(rr-1);
WLSVAR1=s2wls*inv(Seinv1*Seinv1);MSE3=MSE3+(bb1[1]-sqrt(1/82))^2;
UL1=bb1[1]+2.01*sqrt(WLSVAR1);
LL1=bb1[1]-2.01*sqrt(WLSVAR1);
    if LL1<=sqrt(1/82) and UL1>=sqrt(1/82);
        cov3=cov3+1;
    endif;
bb2=inv(Seinv1*Seinv1)*Seinv1*t1;sum2=sum2+bb2;
s2wls2=(t1-Seinv1*bb2)*(t1-Seinv1*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv1*Seinv1);MSE4=MSE4+(bb2[1]-sqrt(1/82))^2;
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
        cov4=cov4+1;
    endif;
/* The below program calculates RE */
Wave1=sumW1/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-r*Wave1^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1)); /*Eq (5.5)*/
Q=(W1i*b2^2)-(b2*W1i)^2/sumW1; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]); /*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight*z1;
REWA1=(b2*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);
llr=REWA1-1.96*sqrt(VARRE);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        cov1=cov1+1;
    endif;
sum5=sum5+REWA1;MSE1=MSE1+(REWA1-sqrt(1/82))^2;
Wave2=sumW2/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t2*z1-r*Wave2^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave2-S2w2/(rr*Wave2)); /*Eq (5.5)*/
Q=(W2i*b2^2)-(b2*W2i)^2/sumW2; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq2[iBS]); /*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;

```

```

ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    cov2=cov2+1;
  endif;
  sum7=sum7+REWA2;MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
UWLSBias1=(sum1/rep)-sqrt(1/82);UWLScov1=cov3/rep;
UWLSBias2=(sum2/rep)-sqrt(1/82);UWLScov2=cov4/rep;
REBias1=(sum5/rep)-sqrt(1/82);REcov1=cov1/rep;
REBias2=(sum7/rep)-sqrt(1/82);REcov2=cov2/rep;
WLSRMSE1=(MSE3/rep)^.5;WLSRMSE2=(MSE4/rep)^.5;
RERMSE1=(MSE1/rep)^.5;RERMSE2=(MSE2/rep)^.5;
AveBias=(sum3/rep)-sqrt(1/82);UWLScov1=cov3/rep;
screen on;
n;;AveBias;;REBias1;;REBias2;;UWLSBias2;;UWLSBias1;;REcov1;;REcov2;;UWLScov2;;UWLScov1;;RERMSE1;;RERMSE
2;;WLSRMSE2;;WLSRMSE1;
screen off;

```

GAUSS code for simulations Fisher's z and UWLS₊₃ reported in Table 2

```

/*****
/* PROGRAM: Fisher's Z UWLSn-d Part Corr MAS */
/* AUTHOR: Tom Stanley */
/* 11:38 AM 08-Apr-2023 */
*****/
new;
screen off;
rep=10000;/* the number of replications*/
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={};Seinv2={};Seinv3={};
  t1={};t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
    SEbook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
  j=j+1;
  kk=kk+1;
enddo;

```

```

b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i'*z1;sumW2=W2i'*z1;
sumW1=W1i'*z1;sumW2=W2i'*z1;sumW3=W3i'*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(.5) and UL2>=sqrt(.5);
sum10=sum10+1;
endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.5) and ulr>=sqrt(.5);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/

```

```

weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
"Fishers Z & UWLS+3;Fixed n,2IVs,NoHet,10k reps,True PCC=sqrt(.5)";
"t2, AvePCC, REZ Bias, REEn-3Bias,UWLSn-2 bias, Coverages, RMSEs";
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={}; t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;

```

```

    endo;
    rr=k;
    z1=ones(rr,1);
    ave=b2*z1/rr; sum3=sum3+ave;
    sumW1=W1i*z1;sumW2=W2i*z1;
    sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;

```

```

ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={};t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2-X3;
_olsres=1;
{ nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2't2;

```

```

sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum6=sum6+1;
    endif;
sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;

```

```

FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={};Seinv2={};Seinv3={};
  t1={};t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
    SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
  endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2't2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(.5) and UL2>=sqrt(.5);
    sum10=sum10+1;
  endif;
kk=kk+1;
enddo;

```

```

bb3=inv(Seinv3'*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.5) and ulr>=sqrt(.5);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.5) and ulr>=sqrt(.5);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;

```

```

Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={};Seinv2={};Seinv3={};
  t1={}; t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
    SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
  endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(.5) and UL2>=sqrt(.5);
    sum10=sum10+1;
  endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/

```

```

Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
  if Q<=rr-1;
  BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
  weighti=1/(BSvar+Ssq1[iBS]); /*Eq(5.7)*/
  weight=weight|weighti;
  iBS=iBS+1;
  endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
  if llr<=sqrt(.5) and ulr>=sqrt(.5);
  sum4=sum4+1;
  endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3'*z1-rr*Wave3^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3)); /*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
  if Q<=rr-1;
  BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
  weighti=1/(BSvar+Ssq3[iBS]); /*Eq(5.7)*/
  weight=weight|weighti;
  iBS=iBS+1;
  endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(.5) and ulr>=sqrt(.5);
  sum6=sum6+1;
  endif;
sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
  endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
Isq;AveBias;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
  do while (kk<=rep); /* the number of replications*/
  Seinv1={ };Seinv2={ };Seinv3={ };

```

```

t1={}; t2={}; b2={}; t3={};
W1i={}; Zf={};
Ssq1={}; Ssq3={};
W2i={}; W3i={};
Ssq2={};
j=1;
do while (j<=k);
    X2=rdn(n,1)/3;
X3=rdn(n,1); X4=rdn(n,1); X5=rdn(n,1); X6=rdn(n,1); X7=rdn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rdn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2]; pcpart=ti^2+n; pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4); SErob=(1-pccz^2)/sqrt(n-3);
    SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz; Seinv1i=1/SEz; t2i=pcc/SEBook; Seinv2i=1/SEBook;
    t3i=pccz/SErob; Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i; t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i; t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i; t3=t3|t3i;
    b2=b2|pccz; Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2; W3ii=Seinv3i^2;
    W1i=W1i|W1ii; W2i=W2i|W2ii; W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2; Ssq2=Ssq2|SEBook^2; Ssq3=Ssq3|SErob^2;
    j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1; sumW2=W2i*z1;
sumW1=W1i*z1; sumW2=W2i*z1; sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.1)); MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.1) and UL2>=sqrt(.1);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0; I2=0; endif; sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1)); /*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={};
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]); /*Eq(5.7)*/

```

```

    weight=weight|weighti;
    iBS=iBS+1;
    endo;
    sumWeight1=weight'*z1;
    REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
    VARRE=1/sumWeight1;
    ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
    llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
    sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3'*z1-rr*Wave3^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3)); /*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
if Q<=rr-1;
    BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]); /*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;
    sumWeight2=weight'*z1;
    REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
    VARRE2=1/sumWeight2;
    ulr=REWA2+1.96*sqrt(VARRE2);
    llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
    sum6=sum6+1;
    endif;
    sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
    kk=kk+1;
    endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
"Fishers Z & UWLS+3;Fixed n,2IVs,NoHet,10k reps,True PCC=sqrt(.1)";
"I2, AvePCC, REZ Bias, REEn-3Bias,UWLSn-2 bias, Coverages, RMSEs";
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
do while (kk<=rep); /* the number of replications*/
    Seinv1={ };Seinv2={ };Seinv3={ };
    t1={ }; t2={ };b2={ };t3={ };
    W1i={ };Zf={ };
    Ssq1={ };Ssq3={ };
    W2i={ };W3i={ };
    Ssq2={ };
    j=1;

```

```

do while (j<=k);
    X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
    SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.1) and UL2>=sqrt(.1);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;

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```

ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3)); /*Eq (5.5)*/
Q=(W3i'b2^2)-(b2*W3i)^2/sumW3; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]); /*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep); /* the number of replications*/
Seinv1={ };Seinv2={ };Seinv3={ };
t1={ }; t2={ };b2={ };t3={ };
W1i={ };Zf={ };
Ssq1={ };Ssq3={ };
W2i={ };W3i={ };
Ssq2={ };
j=1;
do while (j<=k);
X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);

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```

ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2'*Seinv2)*Seinv2't2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2'*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(.1) and UL2>=sqrt(.1);
sum10=sum10+1;
endif;
bb3=inv(Seinv3'*Seinv3)*Seinv3't3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */

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S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;
    BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
  endo;
sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(.1) and ulr>=sqrt(.1);
    sum6=sum6+1;
  endif;
  sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;AveBias;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
  do while (kk<=rep);/* the number of replications*/
    Sein1={ };Sein2={ };Sein3={ };
    t1={ }; t2={ };b2={ };t3={ };
    W1i={ };Zf={ };
    Ssq1={ };Ssq3={ };
    W2i={ };W3i={ };
    Ssq2={ };
    j=1;
    do while (j<=k);
      X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
      X1=ones(n,1);
      Y=X1+X2+X3+rndn(n,1);
      X=X2~X3;
      _olsres=1;
      { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
      ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
      pccz=ti/sqrt(pcpart-3);
      Zfi=.5*ln((1+pccz)/(1-pccz));
      SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
      SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Sein1i=1/SEz;t2i=pcc/SEbook;Sein2i=1/SEbook;
      t3i=pccz/SErob;Sein3i=1/SErob;
      Sein1=Sein1|Sein1i;t1=t1|t1i;

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Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(.1) and UL2>=sqrt(.1);
sum10=sum10+1;
endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };

```

```

do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight^*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={}; t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;

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    endo;
    rr=k;
    z1=ones(rr,1);
    ave=b2*z1/rr; sum3=sum3+ave;
    sumW1=W1i*z1;sumW2=W2i*z1;
    sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.1) and UL2>=sqrt(.1);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;

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ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={};t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2-X3;
_olsres=1;
{ nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2't2;

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sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum6=sum6+1;
    endif;
sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;

```

```

FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
"Fishers Z & UWLS+3;Fixed n,2IVs,NoHet,10k reps,True PCC=sqrt(1/82)";
"I2, AvePCC, REZ Bias, REEn-3Bias,UWLSn-2 bias, Coverages, RMSEs";
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Sein1={};Sein2={};Sein3={};
  t1={};t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rdn(n,1)/9;
X3=rdn(n,1);X4=rdn(n,1);X5=rdn(n,1);X6=rdn(n,1);X7=rdn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rdn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
    SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Sein1i=1/SEz;t2i=pcc/SEbook;Sein2i=1/SEbook;
    t3i=pccz/SErob;Sein3i=1/SErob;
    Sein1=Sein1|Sein1i;t1=t1|t1i;
    Sein2=Sein2|Sein2i;t2=t2|t2i;
    Sein3=Sein3|Sein3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Sein1i^2;
    W2ii=Sein2i^2;W3ii=Sein3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
  sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Sein2*Sein2)*Sein2*t2;
sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Sein2*bb2)*(t2-Sein2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Sein2*Sein2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);

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```

        sum10=sum10+1;
    endif;
bb3=inv(Seinv3'*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1'*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3'*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum6=sum6+1;
    endif;
    sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);

```

```

AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={};Seinv2={};Seinv3={};
  t1={}; t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
    SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
  sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
  bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
  sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
  s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
  WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
  UL2=bb2[1]+2.01*sqrt(WLSVAR2);
  LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
    sum10=sum10+1;
  endif;
  bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
  s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
  I2=(s2wls3-1)/s2wls3;
  if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
  Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */

```

```

S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
  if Q<=rr-1;
    BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
  endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
  if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    sum4=sum4+1;
  endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
  if Q<=rr-1;
    BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
  endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    sum6=sum6+1;
  endif;
sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
  endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;

```

```

do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={}; t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+rndn(n,1);
X=X2~X3;
_olsres=1;
{ nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
enddo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
sum10=sum10+1;
endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };

```

```

do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={ };Seinv2={ };Seinv3={ };
t1={ }; t2={ };b2={ };t3={ };
W1i={ };Zf={ };
Ssq1={ };Ssq3={ };
W2i={ };W3i={ };
Ssq2={ };
j=1;

```

```

do while (j<=k);
    X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+rndn(n,1);
    X=X2~X3;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-4);SErob=(1-pccz^2)/sqrt(n-3);
    SEBook=sqrt((1-pcc^2)/(n));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2't2;
sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3't3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;
sumWeight1=weight*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;

```

```

ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
  if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    sum4=sum4+1;
  endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3)); /*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
  if Q<=rr-1;
    BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]); /*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
  endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    sum6=sum6+1;
  endif;
  sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
  endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;

/*****
/* PROGRAM: Fisher's Z UWLSn-d Part Corr MAs */
/* AUTHOR: Tom Stanley */
/* 11:38 AM 08-Apr-2023 */
/*****
new;
screen off;
rep=10000; /* the number of replications*/
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
  do while (kk<=rep); /* the number of replications*/
    Seinv1={ };Seinv2={ };Seinv3={ };
    t1={ }; t2={ };b2={ };t3={ };
    W1i={ };Zf={ };
    Ssq1={ };Ssq3={ };
    W2i={ };W3i={ };
    Ssq2={ };

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j=1;
do while (j<=k);
    X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+X4+X5+rndn(n,1);
    X=X2~X3~X4~X5;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
    SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2'*z1/rr; sum3=sum3+ave;
sumW1=W1i'*z1;sumW2=W2i'*z1;
sumW1=W1i'*z1;sumW2=W2i'*z1;sumW3=W3i'*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2'*Seinv2)*Seinv2't2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2'*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3'*Seinv3)*Seinv3't3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1'*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/

```

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VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
  if llr<=sqrt(.5) and ulr>=sqrt(.5);
    sum4=sum4+1;
  endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;
    BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
  endo;
sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(.5) and ulr>=sqrt(.5);
    sum6=sum6+1;
  endif;
  sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
"Fishers Z & UWLSn-2;Fixed n,4IVs,NoHet,10k reps,True PCC=sqrt(.5)";
"I2, AvePCC, REZ Bias, REEn-3Bias,UWLSn-2 bias, Coverages, RMSEs";
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
  do while (kk<=rep);/* the number of replications*/
    Seinv1={ };Seinv2={ };Seinv3={ };
    t1={ }; t2={ };b2={ };t3={ };
    W1i={ };Zf={ };
    Ssq1={ };Ssq3={ };
    W2i={ };W3i={ };
    Ssq2={ };
    j=1;
    do while (j<=k);
      X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
      X1=ones(n,1);
      Y=X1+X2+X3+X4+X5+rndn(n,1);

```

```

X=X2~X3~X4~X5;
_olsres=1;
{ nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
end;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(.5) and UL2>=sqrt(.5);
sum10=sum10+1;
endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
end;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.5) and ulr>=sqrt(.5);
sum4=sum4+1;
endif;

```

```

REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;
  BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
  weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
  weight=weight|weighti;
  iBS=iBS+1;
  endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(.5) and ulr>=sqrt(.5);
  sum6=sum6+1;
  endif;
  sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
  kk=kk+1;
  endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
Isq;AveBias;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
  do while (kk<=rep);/* the number of replications*/
  Seinv1={ };Seinv2={ };Seinv3={ };
  t1={ }; t2={ };b2={ };t3={ };
  W1i={ };Zf={ };
  Ssq1={ };Ssq3={ };
  W2i={ };W3i={ };
  Ssq2={ };
  j=1;
  do while (j<=k);
  X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
  X1=ones(n,1);
  Y=X1+X2+X3+X4+X5+rndn(n,1);
  X=X2~X3~X4~X5;
  _olsres=1;
  { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
  ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
  pccz=ti/sqrt(pcpart-3);
  Zfi=.5*ln((1+pccz)/(1-pccz));
  SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
  SEBook=sqrt((1-pcc^2)/(n-2));

```

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t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;

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    BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum6=sum6+1;
    endif;
    sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
    endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
    do while (kk<=rep);/* the number of replications*/
        Seinv1={ };Seinv2={ };Seinv3={ };
        t1={ }; t2={ };b2={ };t3={ };
        W1i={ };Zf={ };
        Ssq1={ };Ssq3={ };
        W2i={ };W3i={ };
        Ssq2={ };
        j=1;
        do while (j<=k);
            X2=rdn(n,1);
X3=rdn(n,1);X4=rdn(n,1);X5=rdn(n,1);X6=rdn(n,1);X7=rdn(n,1);
            X1=ones(n,1);
            Y=X1+X2+X3+X4+X5+rdn(n,1);
            X=X2~X3~X4~X5;
            _olsres=1;
            { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
            ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
            pccz=ti/sqrt(pcpart-3);
            Zfi=.5*ln((1+pccz)/(1-pccz));
            SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
            SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
            t3i=pccz/SErob;Seinv3i=1/SErob;
            Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
            Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
            Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
            b2=b2|pccz;Zf=Zf|Zfi;
            W1ii=Seinv1i^2;
            W2ii=Seinv2i^2;W3ii=Seinv3i^2;

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W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(.5) and UL2>=sqrt(.5);
sum10=sum10+1;
endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.5) and ulr>=sqrt(.5);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;

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sumWeight2=weight'*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum6=sum6+1;
    endif;
    sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
Isq;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
    Seinv1={};Seinv2={};Seinv3={};
    t1={}; t2={};b2={};t3={};
    W1i={};Zf={};
    Ssq1={};Ssq3={};
    W2i={};W3i={};
    Ssq2={};
    j=1;
    do while (j<=k);
        X2=rndn(n,1);
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
        X1=ones(n,1);
        Y=X1+X2+X3+X4+X5+rndn(n,1);
        X=X2~X3~X4~X5;
        _olsres=1;
        { nam,m,b,spb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
        ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
        pccz=ti/sqrt(pcpart-3);
        Zfi=.5*ln((1+pccz)/(1-pccz));
        SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
        SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEBook;Seinv2i=1/SEBook;
        t3i=pccz/SErob;Seinv3i=1/SErob;
        Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
        Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
        Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
        b2=b2|pccz;Zf=Zf|Zfi;
        W1ii=Seinv1i^2;
        W2ii=Seinv2i^2;W3ii=Seinv3i^2;
        W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
        Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
        j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i'*z1;sumW2=W2i'*z1;

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sumW1=W1i'*z1;sumW2=W2i'*z1;sumW3=W3i'*z1;
/* This calculates UWLsn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2't2;
sum2=sum2+(bb2-sqrt(.5));MSE4=MSE4+(bb2-sqrt(.5))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.5) and UL2>=sqrt(.5);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3't3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.5));MSE1=MSE1+(REzCorr-sqrt(.5))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.5) and ulr>=sqrt(.5);
        sum6=sum6+1;
    endif;

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sum7=sum7+(REWA2-sqrt(.5));MSE2=MSE2+(REWA2-sqrt(.5))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.5);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={};t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rdn(n,1)/3;
X3=rdn(n,1);X4=rdn(n,1);X5=rdn(n,1);X6=rdn(n,1);X7=rdn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+X4+X5+rdn(n,1);
X=X2~X3~X4~X5;
_olsres=1;
{ nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEBook;Seinv2i=1/SEBook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);

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        if LL2<=sqrt(.1) and UL2>=sqrt(.1);
            sum10=sum10+1;
        endif;
bb3=inv(Seinv3'*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b^2)-(b2'*W3i)^2/sumW3; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        sum6=sum6+1;
    endif;
sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;

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covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
"Fishers Z & UWLSn-2;Fixed n,4IVs,NoHet,10k reps,True PCC=sqrt(.1)";
"I2, AvePCC, REZ Bias, REEn-3Bias,UWLSn-2 bias, Coverages, RMSEs";
lsq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={};Seinv2={};Seinv3={};
  t1={}; t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+X4+X5+rndn(n,1);
    X=X2~X3~X4~X5;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
    SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
  sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
  bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
  sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
  s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
  WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
  UL2=bb2[1]+2.01*sqrt(WLSVAR2);
  LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.1) and UL2>=sqrt(.1);
      sum10=sum10+1;
    endif;
  bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
  s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
  I2=(s2wls3-1)/s2wls3;

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if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;

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sum4=0;sum5=0;sum6=0;sum7=0;sum8=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={};Seinv2={};Seinv3={};
  t1={}; t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rdn(n,1)/3;
X3=rdn(n,1);X4=rdn(n,1);X5=rdn(n,1);X6=rdn(n,1);X7=rdn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+X4+X5+rdn(n,1);
    X=X2~X3~X4~X5;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
    SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEBook;Seinv2i=1/SEBook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
  sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
  if LL2<=sqrt(.1) and UL2>=sqrt(.1);
    sum10=sum10+1;
  endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REZ & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;

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    BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        sum6=sum6+1;
    endif;
    sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
    endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
    do while (kk<=rep);/* the number of replications*/
        Seinv1={ };Seinv2={ };Seinv3={ };
        t1={ }; t2={ };b2={ };t3={ };
        W1i={ };Zf={ };
        Ssq1={ };Ssq3={ };

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W2i={ };W3i={ };
Ssq2={ };
j=1;
do while (j<=k);
    X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+X4+X5+rndn(n,1);
    X=X2~X3~X4~X5;
    _olsres=1;
    { nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
    SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEBook;Seinv2i=1/SEBook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i'*z1;sumW2=W2i'*z1;
sumW1=W1i'*z1;sumW2=W2i'*z1;sumW3=W3i'*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2'*Seinv2)*Seinv2't2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2'*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(.1) and UL2>=sqrt(.1);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3'*Seinv3)*Seinv3't3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;

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sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr; /*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3'*z1-rr*Wave3^2)/(rr-1); /*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3)); /*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3; /*Eq (3.2)*/
BSvar=(Q-rr+1)/U; /*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]); /*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(.1) and ulr>=sqrt(.1);
        sum6=sum6+1;
    endif;
sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;AveBias;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep); /* the number of replications*/
    Seinv1={ };Seinv2={ };Seinv3={ };
    t1={ }; t2={ };b2={ };t3={ };
    W1i={ };Zf={ };
    Ssq1={ };Ssq3={ };
    W2i={ };W3i={ };
    Ssq2={ };
    j=1;
    do while (j<=k);
        X2=rndn(n,1)/3;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
        X1=ones(n,1);
        Y=X1+X2+X3+X4+X5+rndn(n,1);

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X=X2~X3~X4~X5;
_olsres=1;
{ nam,m,b,stab,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
end;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(.1));MSE4=MSE4+(bb2-sqrt(.1))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(.1) and UL2>=sqrt(.1);
sum10=sum10+1;
endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
end;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(.1) and ulr>=sqrt(.1);
sum4=sum4+1;
endif;

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REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(.1));MSE1=MSE1+(REzCorr-sqrt(.1))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;
  BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
  weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
  weight=weight|weighti;
  iBS=iBS+1;
  endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(.1) and ulr>=sqrt(.1);
  sum6=sum6+1;
  endif;
  sum7=sum7+(REWA2-sqrt(.1));MSE2=MSE2+(REWA2-sqrt(.1))^2;
kk=kk+1;
  endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(.1);
screen on;
Isq;AveBias;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=25;k=50;
kk=1;
  do while (kk<=rep);/* the number of replications*/
  Seinv1={ };Seinv2={ };Seinv3={ };
  t1={ }; t2={ };b2={ };t3={ };
  W1i={ };Zf={ };
  Ssq1={ };Ssq3={ };
  W2i={ };W3i={ };
  Ssq2={ };
  j=1;
  do while (j<=k);
  X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
  X1=ones(n,1);
  Y=X1+X2+X3+X4+X5+rndn(n,1);
  X=X2~X3~X4~X5;
  _olsres=1;
  { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
  ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
  pccz=ti/sqrt(pcpart-3);
  Zfi=.5*ln((1+pccz)/(1-pccz));
  SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
  SEBook=sqrt((1-pcc^2)/(n-2));

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t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEbook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
    endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
    endo;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;

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    BSvar=0;
    endif;
iBS=1; weight={ };
    do while (iBS<=rr);
        weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
        weight=weight|weighti;
        iBS=iBS+1;
    endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum6=sum6+1;
    endif;
    sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
    endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
"Fishers Z & UWLSn-2;Fixed n,4IVs,NoHet,10k reps,True PCC=sqrt(1/82)";
"I2, AvePCC, REZ Bias, REEn-3Bias,UWLSn-2 bias, Coverages, RMSEs";
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=50;k=50;
kk=1;
    do while (kk<=rep);/* the number of replications*/
        Seinv1={ };Seinv2={ };Seinv3={ };
        t1={ }; t2={ };b2={ };t3={ };
        W1i={ };Zf={ };
        Ssq1={ };Ssq3={ };
        W2i={ };W3i={ };
        Ssq2={ };
        j=1;
        do while (j<=k);
            X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
            X1=ones(n,1);
            Y=X1+X2+X3+X4+X5+rndn(n,1);
            X=X2~X3~X4~X5;
            _olsres=1;
            { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
            ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
            pccz=ti/sqrt(pcpart-3);
            Zfi=.5*ln((1+pccz)/(1-pccz));
            SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
            SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
            t3i=pccz/SErob;Seinv3i=1/SErob;
            Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
            Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
            Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
            b2=b2|pccz;Zf=Zf|Zfi;

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W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2'*z1/rr; sum3=sum3+ave;
sumW1=W1i'*z1;sumW2=W2i'*z1;
sumW1=W1i'*z1;sumW2=W2i'*z1;sumW3=W3i'*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2'*Seinv2)*Seinv2't2;
sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2'*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
sum10=sum10+1;
endif;
bb3=inv(Seinv3'*Seinv3)*Seinv3't3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
weight=weight|weighti;
iBS=iBS+1;
endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
sum4=sum4+1;
endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
if Q<=rr-1;
BSvar=0;
endif;
iBS=1; weight={ };
do while (iBS<=rr);
weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
weight=weight|weighti;

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iBS=iBS+1;
endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=100;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={}; t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+X4+X5+rndn(n,1);
X=X2~X3~X4~X5;
_olsres=1;
{ nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEBook;Seinv2i=1/SEBook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);

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ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i*Zf^2)-(Zf*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight1=weight*z1;
REWA1=(Zf*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i*b2^2)-(b2*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
endo;
sumWeight2=weight*z1;
REWA2=(b2*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);

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sum6=sum6+1;
endif;
sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=200;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
Seinv1={};Seinv2={};Seinv3={};
t1={};t2={};b2={};t3={};
W1i={};Zf={};
Ssq1={};Ssq3={};
W2i={};W3i={};
Ssq2={};
j=1;
do while (j<=k);
X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
X1=ones(n,1);
Y=X1+X2+X3+X4+X5+rndn(n,1);
X=X2~X3~X4~X5;
_olsres=1;
{ nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
pccz=ti/sqrt(pcpart-3);
Zfi=.5*ln((1+pccz)/(1-pccz));
SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEBook;Seinv2i=1/SEBook;
t3i=pccz/SErob;Seinv3i=1/SErob;
Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
b2=b2|pccz;Zf=Zf|Zfi;
W1ii=Seinv1i^2;
W2ii=Seinv2i^2;W3ii=Seinv3i^2;
W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
j=j+1;
endo;
rr=k;
z1=ones(rr,1);
ave=b2*z1/rr; sum3=sum3+ave;
sumW1=W1i*z1;sumW2=W2i*z1;
sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
WLSVAR2=s2wls2*inv(Seinv2*Seinv2);

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UL2=bb2[1]+2.01*sqrt(WLSVAR2);
LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
        sum10=sum10+1;
    endif;
bb3=inv(Seinv3'*Seinv3)*Seinv3't3;
s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
I2=(s2wls3-1)/s2wls3;
if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
enddo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum4=sum4+1;
    endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b2^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
    if Q<=rr-1;
        BSvar=0;
    endif;
iBS=1; weight={ };
do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
enddo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
    if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
        sum6=sum6+1;
    endif;
sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
enddo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);

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REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;
sum1=0;sum2=0;sum3=0;sum10=0;MSE1=0;MSE2=0;MSE3=0;MSE4=0;
sum4=0;sum5=0;sum6=0;sum7=0;sum9=0;sum8=0;cov1=0;cov4=0;cov2=0;cov3=0;
n=400;k=50;
kk=1;
do while (kk<=rep);/* the number of replications*/
  Seinv1={};Seinv2={};Seinv3={};
  t1={}; t2={};b2={};t3={};
  W1i={};Zf={};
  Ssq1={};Ssq3={};
  W2i={};W3i={};
  Ssq2={};
  j=1;
  do while (j<=k);
    X2=rndn(n,1)/9;
X3=rndn(n,1);X4=rndn(n,1);X5=rndn(n,1);X6=rndn(n,1);X7=rndn(n,1);
    X1=ones(n,1);
    Y=X1+X2+X3+X4+X5+rndn(n,1);
    X=X2~X3~X4~X5;
    _olsres=1;
    { nam,m,b,stb,vc,std,sig,cx,rsq,resid,dbw } = ols(0,Y,X);
    ti=(b[2])/std[2];pcpart=ti^2+n-2;pcc=ti/sqrt(pcpart);
    pccz=ti/sqrt(pcpart-3);
    Zfi=.5*ln((1+pccz)/(1-pccz));
    SEz=1/sqrt(n-6);SErob=(1-pccz^2)/sqrt(n-5);
    SEBook=sqrt((1-pcc^2)/(n-2));
t1i=Zfi/SEz;Seinv1i=1/SEz;t2i=pcc/SEbook;Seinv2i=1/SEbook;
    t3i=pccz/SErob;Seinv3i=1/SErob;
    Seinv1=Seinv1|Seinv1i;t1=t1|t1i;
    Seinv2=Seinv2|Seinv2i;t2=t2|t2i;
    Seinv3=Seinv3|Seinv3i;t3=t3|t3i;
    b2=b2|pccz;Zf=Zf|Zfi;
    W1ii=Seinv1i^2;
    W2ii=Seinv2i^2;W3ii=Seinv3i^2;
    W1i=W1i|W1ii;W2i=W2i|W2ii;W3i=W3i|W3ii;
    Ssq1=Ssq1|SEz^2;Ssq2=Ssq2|SEBook^2;Ssq3=Ssq3|SErob^2;
    j=j+1;
  endo;
  rr=k;
  z1=ones(rr,1);
  ave=b2*z1/rr; sum3=sum3+ave;
  sumW1=W1i*z1;sumW2=W2i*z1;
  sumW1=W1i*z1;sumW2=W2i*z1;sumW3=W3i*z1;
/* This calculates UWLSn-d */
  bb2=inv(Seinv2*Seinv2)*Seinv2*t2;
  sum2=sum2+(bb2-sqrt(1/82));MSE4=MSE4+(bb2-sqrt(1/82))^2;
  s2wls2=(t2-Seinv2*bb2)*(t2-Seinv2*bb2)/(rr-1);
  WLSVAR2=s2wls2*inv(Seinv2*Seinv2);
  UL2=bb2[1]+2.01*sqrt(WLSVAR2);
  LL2=bb2[1]-2.01*sqrt(WLSVAR2);
    if LL2<=sqrt(1/82) and UL2>=sqrt(1/82);
      sum10=sum10+1;
    endif;
  bb3=inv(Seinv3*Seinv3)*Seinv3*t3;
  s2wls3=(t3-Seinv3*bb3)*(t3-Seinv3*bb3)/(rr-1);
  I2=(s2wls3-1)/s2wls3;

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if I2<0;I2=0;endif;sum8=sum8+I2;
/* The below calculates REz & REdf */
Wave1=sumW1/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w1=(t1*z1-rr*Wave1^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave1-S2w1/(rr*Wave1));/*Eq (5.5)*/
Q=(W1i'Zf^2)-(Zf'*W1i)^2/sumW1;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;
    BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
    weighti=1/(BSvar+Ssq1[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
  endo;
sumWeight1=weight'*z1;
REWA1=(Zf'*weight)/sumWeight1; /*Eq(5.8)*/
VARRE=1/sumWeight1;
ulr=REWA1+1.96*sqrt(VARRE);ulr=((exp(2*ulr)-1)/(exp(2*ulr)+1));
llr=REWA1-1.96*sqrt(VARRE);llr=((exp(2*llr)-1)/(exp(2*llr)+1));
  if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    sum4=sum4+1;
  endif;
REzCorr=(exp(2*REWA1)-1)/(exp(2*REWA1)+1);
sum5=sum5+(REzCorr-sqrt(1/82));MSE1=MSE1+(REzCorr-sqrt(1/82))^2;
Wave3=sumW3/rr;/*see Eq (5.3) in Sutton et al (2000) */
S2w2=(t3*z1-rr*Wave3^2)/(rr-1);/*Eq (5.4)*/
U=(rr-1)*(Wave3-S2w2/(rr*Wave3));/*Eq (5.5)*/
Q=(W3i'b^2)-(b2'*W3i)^2/sumW3;/*Eq (3.2)*/
BSvar=(Q-rr+1)/U;/*Eq (5.6)*/
  if Q<=rr-1;
    BSvar=0;
  endif;
iBS=1; weight={ };
  do while (iBS<=rr);
    weighti=1/(BSvar+Ssq3[iBS]);/*Eq(5.7)*/
    weight=weight|weighti;
    iBS=iBS+1;
  endo;
sumWeight2=weight'*z1;
REWA2=(b2'*weight)/sumWeight2; /*Eq(5.8)*/
VARRE2=1/sumWeight2;
ulr=REWA2+1.96*sqrt(VARRE2);
llr=REWA2-1.96*sqrt(VARRE2);
  if llr<=sqrt(1/82) and ulr>=sqrt(1/82);
    sum6=sum6+1;
  endif;
sum7=sum7+(REWA2-sqrt(1/82));MSE2=MSE2+(REWA2-sqrt(1/82))^2;
kk=kk+1;
endo;
FEBias1=(sum1/rep);RMSE1=(MSE1/rep)^.5;
UWLSnBias=(sum2/rep);RMSE2=(MSE2/rep)^.5;
REBias1=(sum5/rep);
REBias2=(sum7/rep);RMSE4=(MSE4/rep)^.5;
CovUWLSn=(sum10/rep);Isq=sum8/rep;
covRE1=(sum4/rep);covRE2=(sum6/rep);
AveBias=(sum3/rep)-sqrt(1/82);
screen on;
Isq;;AveBias;;REBias1;;REBias2;;UWLSnBias;;covRE1;;covRE2;;covUWLSn;;RMSE1;;RMSE2;;RMSE4;
screen off;

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