1.

```
. xtgls y x1 x2 x3 x4 x5 x6 x7

Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        homoskedastic
Correlation:   no autocorrelation

Estimated covariances      =         1          Number of obs     =      1,275
Estimated autocorrelations =         0          Number of groups  =        255
Estimated coefficients     =         8          Time periods      =          5
                                                Wald chi2(7)      =     899.95
Log likelihood             =  209.4322          Prob > chi2       =     0.0000
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	.0794732	.0093881	8.47	0.000	.0610728	.0978735
x2	.0183375	.0051421	3.57	0.000	.0082592	.0284158
x3	.0977707	.0526329	1.86	0.063	-.0053879	.2009293
x4	.0873838	.2186064	0.40	0.689	-.3410767	.5158444
x5	-.1076457	.0069214	-15.55	0.000	-.1212114	-.0940801
x6	-.1432493	.0186811	-7.67	0.000	-.1798637	-.106635
x7	-.2712849	.011995	-22.62	0.000	-.2947946	-.2477753
_cons	-.0107965	.0860341	-0.13	0.900	-.1794201	.1578272

```
. est store pgls

. xtgls y x1 x2 x3 x4 x5 x6 x7, igls panels(heteroskedastic) nolog


Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   no autocorrelation

Estimated covariances      =       255          Number of obs     =      1,275
Estimated autocorrelations =         0          Number of groups  =        255
Estimated coefficients     =         8          Time periods      =          5
                                                Wald chi2(7)      =    3850.64
Log likelihood             =   519.361          Prob > chi2       =     0.0000
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	.0834067	.0045748	18.23	0.000	.0744403	.0923732
x2	.0163976	.0032919	4.98	0.000	.0099456	.0228497
x3	-.3631261	.0505673	-7.18	0.000	-.4622362	-.264016
x4	.3191455	.1093883	2.92	0.004	.1047484	.5335426
x5	-.1093301	.0043601	-25.07	0.000	-.1178758	-.1007844
x6	.1361732	.0275038	4.95	0.000	.0822667	.1900797
x7	-.2282655	.0063087	-36.18	0.000	-.2406303	-.2159007
_cons	-.037658	.0426502	-0.88	0.377	-.1212509	.0459349

```
. est store hete

. local df=e(N_g)-1

. lrtest hete pgls, df(`df')

Likelihood-ratio test                                 LR chi2(254)=    619.86
(Assumption: pgls nested in hete)                     Prob > chi2 =    0.0000
```

According to LR chi-square test, LR-chi2 test is 619.86 with P-value of 0.0000 < 0.05. Hence, H**0** is rejected, and there exists heteroskedasticity in the model.

2.

```
. xtgls y x1 x2 x3 x4 x5 x6 x7

Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        homoskedastic
Correlation:   no autocorrelation

Estimated covariances      =         1          Number of obs     =      1,275
Estimated autocorrelations =         0          Number of groups  =        255
Estimated coefficients     =         8          Time periods      =          5
                                                Wald chi2(7)      =     899.95
Log likelihood             =  209.4322          Prob > chi2       =     0.0000
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	.0794732	.0093881	8.47	0.000	.0610728	.0978735
x2	.0183375	.0051421	3.57	0.000	.0082592	.0284158
x3	.0977707	.0526329	1.86	0.063	-.0053879	.2009293
x4	.0873838	.2186064	0.40	0.689	-.3410767	.5158444
x5	-.1076457	.0069214	-15.55	0.000	-.1212114	-.0940801
x6	-.1432493	.0186811	-7.67	0.000	-.1798637	-.106635
x7	-.2712849	.011995	-22.62	0.000	-.2947946	-.2477753
_cons	-.0107965	.0860341	-0.13	0.900	-.1794201	.1578272

```
. est store pgls


. xtreg y x1 x2 x3 x4 x5 x6 x7, fe

Fixed-effects (within) regression               Number of obs     =      1,275
Group variable: crossid                         Number of groups  =        255

R-sq:                                           Obs per group:
     within  = 0.3772                                         min =          5
     between = 0.1103                                         avg =        5.0
     overall = 0.1644                                         max =          5

                                                F(7,1013)         =      87.64
corr(u_i, Xb)  = -0.2003                        Prob > F          =     0.0000
```

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
x1	-.1256447	.0180942	-6.94	0.000	-.161151	-.0901384
x2	.0123739	.008023	1.54	0.123	-.0033697	.0281176
x3	.0747825	.039773	1.88	0.060	-.0032643	.1528293
x4	.6493144	.2855092	2.27	0.023	.0890573	1.209572
x5	-.1104883	.0061097	-18.08	0.000	-.1224773	-.0984992
x6	-.1461423	.0141035	-10.36	0.000	-.1738178	-.1184669
x7	-.0951497	.0121853	-7.81	0.000	-.1190611	-.0712383
_cons	1.756067	.1658407	10.59	0.000	1.430636	2.081497
sigma_u	.22676694					
sigma_e	.11725953					
rho	.78902632	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(254, 1013) = 11.40                     Prob > F = 0.0000

. est store fixed
```

```
. xtreg y x1 x2 x3 x4 x5 x6 x7, re

Random-effects GLS regression                   Number of obs     =      1,275
Group variable: crossid                         Number of groups  =        255

R-sq:                                           Obs per group:
     within  = 0.3492                                         min =          5
     between = 0.3404                                         avg =        5.0
     overall = 0.3377                                         max =          5

                                                Wald chi2(7)      =     663.43
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	-.0145018	.0133366	-1.09	0.277	-.040641	.0116375
x2	.0146948	.0064463	2.28	0.023	.0020604	.0273292
x3	.0985565	.0399464	2.47	0.014	.020263	.1768501
x4	.4693539	.2493856	1.88	0.060	-.0194329	.9581407
x5	-.1117985	.005959	-18.76	0.000	-.1234779	-.100119
x6	-.1541318	.014125	-10.91	0.000	-.1818163	-.1264472
x7	-.1494529	.0115006	-13.00	0.000	-.1719937	-.1269122
_cons	.7714573	.1226841	6.29	0.000	.5310009	1.011914
sigma_u	.15944933					
sigma_e	.11725953					
rho	.64900604	(fraction of variance due to u_i)				

```
. est store random

. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
x1	-.1256447	-.0145018	-.1111429	.0122284
x2	.0123739	.0146948	-.0023208	.0047765
x3	.0747825	.0985565	-.0237741	.
x4	.6493144	.4693539	.1799605	.1390048
x5	-.1104883	-.1117985	.0013102	.0013484
x6	-.1461423	-.1541318	.0079894	.
x7	-.0951497	-.1494529	.0543033	.0040273

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

 Test:  Ho:  difference in coefficients not systematic

           chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                   =      190.39
         Prob>chi2 =      0.0000
         (V_b-V_B is not positive definite)
```

According to the Hausman test between fixed effects and random effects, Chi-square test is 190.39 with P-value of 0.0000 < 0.05, therefore, H0 is rejected which means fixed effect is highly correlated with Xs in the model. Therefore, the Fixed Effects model is more appropriate in this model.