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1. . xtglm 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 = 1275
Estimated autocorrelations = 0 Number of groups = 255
Estimated coefficients = 8 Time periods = 5
Log likelihood = 519.361 Wald chi2(7) = 3850.64
Prob > chi2 = 0.0000
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y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
x1	.0834067	.0045748	18.23	0.000	.0744403 .09223732
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	-.2712849	.0063087	-36.18	0.000	-.2406303 -.2159007
_cons	-.037658	.0426502	-0.88	0.377	-.1212509 .0459349

```
. est store het
. xtglm y x1 x2 x3 x4 x5 x6 x7 (w/o any problems)
Cross-sectional time-series FGLS regression
Coefficients: generalized least squares
Panels: homoskedastic
Correlation: no autocorrelation
Estimated covariances = 1 Number of obs = 1275
Estimated autocorrelations = 0 Number of groups = 255
Estimated coefficients = 8 Time periods = 5
Log likelihood = 209.4322 Wald chi2(7) = 899.95
Prob > chi2 = 0.0000
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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 pgl5
. local df=e(N_g)-1
. lrtest het, df(`df')
Likelihood-ratio test (Assumption: pgl5 nested in het) LR chi2(254)= 619.86
Prob > chi2 = 0.0000
```

Ans. The LR- χ^2 value fall into rejection region of 0.05 level of significance
 H_0 is rejected, Heteroscedasticity exist.

y	Coef.
x1	-.1256447
x2	.0123739
x3	.0747825
x4	.6493144
x5	-.1104883
x6	-.1461423
x7	-.0951497
_cons	1.756067

2. Sign & meaning

- $\beta_1 = -0.126$
 \Rightarrow If size of firm determined by log of total revenue increase by unit leverage of firm i in year t will decrease by 0.126 unit.
- $\beta_2 = 0.012$
 \Rightarrow If tangibles asset of the firm determined by log of tangible assets plus inventories divided by total book assets increase by unit, leverage of firm i in year t will increase by 0.012 unit
- $\beta_3 = 0.075$
 \Rightarrow If profitability index determined by return on assets increase by unit leverage of firm i in year t will increase by 0.075 unit
- $\beta_4 = 0.15$
 \Rightarrow If non-debt tax shields determined by depreciation divided by total assets increase by unit leverage of firm i in year t will increase by 0.15 unit
- $\beta_5 = -0.11$
 \Rightarrow If growth rate of the firm determined by book value of asset plus market value of equity minus book value of equity then divided by book value of asset increase by unit leverage of firm i in year t will decrease by 0.11 unit
- $\beta_6 = -0.15$
 \Rightarrow If risk of the firm determined by square of deviation from mean of return on asset at period t increase by unit leverage of firm i in year t will decrease by 0.15 unit
- $\beta_7 = -0.1$
 \Rightarrow If dividend payment equals to 1 if firm paid dividend at period t or equals to 0 if no dividend paid increase by unit leverage of firm i in year t will decrease by 0.1 unit

- The F value fall into rejection region of 0.05 level of significance, H_0 is rejected
 All explanatory variables can be used in explaining dependent variable.
- Within $R^2 = 0.3772 \Rightarrow 37.72\%$ of variance between separate panel unit that the model account for.
- The t value fall into rejection region of 0.05 level of significance.
 H_0 is rejected, X_1, X_5, X_6, X_7 are significant & can explain the dependent variable.

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2. . xtglm y x1 x2 x3 x4 x5 x6 x7 Panel least squares model.
Cross-sectional time-series FGLS regression
Coefficients: generalized least squares
Panels: homoskedastic
Correlation: no autocorrelation
Estimated covariances = 1 Number of obs = 1275
Estimated autocorrelations = 0 Number of groups = 255
Estimated coefficients = 8 Time periods = 5
Log likelihood = 209.4322 Wald chi2(7) = 899.95
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

```
. xtreg y x1 x2 x3 x4 x5 x6 x7, fe fixed effect
Fixed-effects (within) regression Number of obs = 1275
Group variable: crossid Number of groups = 255
R-sq: within = 0.3772 Obs per group: min = 5
between = 0.1103 avg = 5.0
overall = 0.1644 max = 5
corr(u_i, xb) = -0.2003 F(7, 1013) = 87.64
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	-.0032697 .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

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 effect
Random-effects GLS regression Number of obs = 1275
Group variable: crossid Number of groups = 255
R-sq: within = 0.3492 Obs per group: min = 5
between = 0.3404 avg = 5.0
overall = 0.3377 max = 5
Random effects u_i ~ Gaussian 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

```
. est store random
hausman fixed random
----- Coefficients -----
(b) (b) (b-B) sqrt(diag(V_b-V_B))
fixed random Difference S.E.
x1 - .1256447 - .0145018 - .1111429 .0122284
x2 . .0123739 .0146948 -.0023208 .0047765
x3 .0747825 .0985565 .0237741 .0257741
x4 .6493144 .4693539 .1799605 .1390048
x5 -.1104883 -.1117985 .0013102 .0013484
x6 -.1461423 -.1541318 .0079894 .0079894
x7 -.0951497 -.1494529 .0543033 .0040273
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b = consistent under H_0 and H_a ; obtained from xtreg
 B = inconsistent under H_a , efficient under H_0 ; obtained from xtreg
 Test: H_0 : difference in coefficients not systematic
 $\chi^2(7) = (b-B)'[(V_b-V_B)^{-1}](b-B)$
 $\text{Prob} > \chi^2 = 0.0000$
 (V_b-V_B is not positive definite)

Ans. Hausman test : The χ^2 square value fall into rejection region of 0.05 level of significance.
 H_0 is rejected, Fixed effect model is more appropriate than random effect or unobserved fixed effect is highly correlated with X_i in the model.
 Fixed effect: $H_0: d_1 = d_2 = \dots = d_n = d$ or $H_0: b_1 = b_2 = \dots = b_n = 0$
 The F value fall into rejection region of 0.05 level of significance
 H_0 is rejected, unobserved fixed effect exist