Assignment 2

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a. State reduce form models of this system. Estimate reduce form models using OLS and prediction of the endogenous variables.

Reduced form :

$$\ln S_t = \beta_1 + \beta_2 \ln P_{x2t} + \beta_3 \ln P_{x3t} + \beta_4 \ln P_{x4t} + \beta_5 \ln GDP_t + W_1$$

$$\ln D_t = \beta_5 + \beta_6 \ln P_{x2t} + \beta_7 \ln P_{x3t} + \beta_8 \ln P_{x4t} + \beta_9 \ln GDP_t + W_2$$

$$\ln P_{Dt} = \beta_{10} + \beta_{11} \ln P_{x2t} + \beta_{12} \ln P_{x3t} + \beta_{13} \ln P_{x4t} + \beta_{14} \ln GDP_t + W_3$$

Estimate reduced form using OLS :

$$\widehat{\ln S_t} = 24.657 - 0.450 \ln P_{x2t} - 0.924 \ln P_{x3t} - 0.388 \ln P_{x4t} + 0.344 \ln GDP_t$$

$$\widehat{\ln D_t} = 27.186 - 0.489 \ln P_{x2t} - 0.724 \ln P_{x3t} - 0.578 \ln P_{x4t} + 0.127 \ln GDP_t$$

$$\widehat{\ln P_t} = 2.877 + 0.132 \ln P_{x2t} + 0.094 \ln P_{x3t} + 0.494 \ln P_{x4t} + 0.163 \ln GDP_t$$

b. Estimate structural form using predicted endogenous variables as independent variables in the structural form models.

$$\ln P_{x2t} = 134.049 + 7.882 \widehat{\ln S_t} - 11.349 \widehat{\ln D_t} - 7.396 \widehat{\ln P_{Dt}}$$

$$\ln P_{x3t} = -26.741 - 2.97 \widehat{\ln S_t} + 3.532 \widehat{\ln D_t} + 2.547 \widehat{\ln P_{Dt}}$$

$$\ln P_{x4t} = -34.28 - 2.38 \widehat{\ln S_t} + 3.01 \widehat{\ln D_t} + 3.246 \widehat{\ln P_{Dt}}$$

$$\ln GDP_t = -6.725 + 2.56 \widehat{\ln S_t} - 1.97 \widehat{\ln P_t} + 0.821 \widehat{\ln P_{Dt}}$$

c. Estimate this system equations model using OLS, 2SLS, 3SLS, and I3SLS. Determine whether there exists endogeneity bias in the estimated results. Concerning on the asymptotic property, which model is the most appropriated model? Why? What do β_{21} and β_{22} mean?

Estimate system equations using OLS;

$$\ln S_t = 41.495 - 1.112 \ln P_{Dt} - 0.419 \ln P_{X2t} - 0.942 \ln P_{X3t} - 0.521 \ln P_{X4t} \quad \text{—(1')}$$

$$\ln D_t = 31.036 - 2.181 \ln P_{Dt} + 0.578 \ln \text{GDP}_t \quad \text{——(2')}$$

2SLS;

$$\ln S_t = 18.6 + 2.106 \ln P_{Dt} - 0.728 \ln P_{X2t} - 1.122 \ln P_{X3t} - 1.429 \ln P_{X4t}$$

$$\ln D_t = 35.935 - 2.574 \ln P_{Dt} + 0.521 \ln \text{GDP}_t$$

3SLS;

$$\ln S_t = 17.849 + 2.172 \ln P_{Dt} - 0.799 \ln P_{X2t} - 1.33 \ln P_{X3t} - 1.17 \ln P_{X4t}$$

$$\ln D_t = 35.935 - 2.574 \ln P_{Dt} + 0.521 \ln \text{GDP}_t$$

I3SLS;

$$\ln S_t = 17.379 + 2.213 \ln P_{Dt} - 0.844 \ln P_{X2t} - 1.46 \ln P_{X3t} - 1.01 \ln P_{X4t}$$

$$\ln D_t = 35.935 - 2.574 \ln P_{Dt} + 0.521 \ln \text{GDP}_t$$

When using the hausman test to determine whether there exists endogeneity, it turns out that H_0 can't be rejected as the p-value = 0.5659. Thus, there is no endogeneity bias in the estimated results.

Concerning on the asymptotic property, there exists a correlation between residuals across equations. Thus, from the situation where there is no endogeneity, but exist residuals' correlation (correlation between residual of (1') & (2') is 0.2422), the model of 3L3 and I3L3 should be used.

β_{21} means when domestic price at time t increases 1%, on average, domestic demand will decrease -2.571%.
Moreover, β_{22} means when GDP at time t increases 1%, on average, domestic demand will increase 0.521%.

Additional Issue: excess demand → P↑ excess supply → P↓

If equilibrium doesn't hold $D_t \neq S_t$, when $D_t > S_t$; then $Q_t = S_t$ but when $D_t < S_t$; then $Q_t = D_t$, where Q_t is transaction quantity at time *t*.

$$\ln Q_t = \beta_{10} + \beta_{11} \ln P_{Dt} + \beta_{12} \ln P_{X2t} + \beta_{13} \ln P_{X3t} + \beta_{14} \ln P_{X4t} + \varepsilon_{1t} \quad (3)$$

$$\ln Q_t = \beta_{20} + \beta_{21} \ln P_{Dt} + \beta_{22} \ln GDP_t + \varepsilon_{2t} \quad (4)$$

d. Generate lnQ_t and estimate the above system equations (model (3) and model (4)) using OLS, 2SLS, and 3SLS using Q_t, and P_{Dt} as endogenous variables and P_{X2t}, P_{X3t}, P_{X4t}, and GDP_t as exogenous variables.

Estimate the system equations using ...

OLS ;

$\ln Q_t = 40.102 - 1.35 \ln P_{dt} - 0.386 \ln P_{x2t} - 0.678 \ln P_{x3t} - 0.361 \ln P_{x4t}$

$\ln Q_t = 31.036 - 2.181 \ln P_{dt} + 0.578 \ln GDP_t$

2SLS ;

$\ln Q_t = 24.956 - 0.775 \ln P_{dt} - 0.591 \ln P_{x2t} - 0.797 \ln P_{x3t} - 0.961 \ln P_{x4t}$

$\ln Q_t = 35.935 - 2.574 \ln P_{dt} + 0.521 \ln GDP_t$

3SLS ;

$\ln Q_t = 24.720 - 0.796 \ln P_{dt} - 0.613 \ln P_{x2t} - 0.862 \ln P_{x3t} - 0.88 \ln P_{x4t}$

$\ln Q_t = 35.935 - 2.574 \ln P_{dt} + 0.521 \ln GDP_t$

e. What are the problems, in term of economic concept and econometric technique, of the estimated results in **d**?

Using OLS to estimate the system of equation that has a simultaneous bias will lead to a biased, inconsistent, and inefficient estimation.
Moreover, using 2SLS will lead to a biased system.
3SLS, also, leads to a biased system and if there exists any specification error in one of the equation, it will spread through all equations.

```
  ___  ____  ____  ____  ____ (R)
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Notes:
      1.  Unicode is supported; see help unicode_advice.
      2.  More than 2 billion observations are allowed; see help obs_advice.
      3.  Maximum number of variables is set to 5000; see help set_maxvar.
      4.  New update available; type -update all-

1 . log using "C:\Users\user\Documents\BE TU\BE Classwork\Year2\EE426\HW2\2.3.smcl"
-------------------------------------------------------------------------------
      name:  <unnamed>
       log:  C:\Users\user\Documents\BE TU\BE Classwork\Year2\EE426\HW2\2.3.smcl
  log type:  smcl
 opened on:   3 Feb 2021, 20:11:46

2 . use "C:\Users\user\Documents\BE TU\BE Classwork\Year2\EE426\HW2\assign2.dta"

3 . describe

Contains data from C:\Users\user\Documents\BE TU\BE Classwork\Year2\EE426\HW2\assign2.dta
  obs:            22
 vars:             9                          28 Jan 2021 13:32
-------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------
obs             int     %8.0g                 OBS
st              long    %12.0g                ST
dt              long    %12.0g                DT
pm              float   %9.0g                 PD
t               float   %9.0g                 TT
px2             float   %9.0g                 PX2
px3             float   %9.0g                 PX3
gdp             float   %9.0g                 GNP
px4             float   %9.0g                 PX4
-------------------------------------------------------------------------------
Sorted by: obs

4 . tsset
        time variable:  obs, 1986 to 2007
                delta:  1 unit

5 . gen lst=ln(st)

6 . gen ldt=ln(dt)

7 . gen lpd=ln(pm+t)
```

```
 8 . gen lpx2=ln(px2)

 9 . gen lpx3=ln(px3)

10 . gen lpx4=ln(px4)

11 . gen lgdp=ln(gdp)

12 . reg lst lpx2 lpx3 lpx4 lgdp
```

Source	SS	df	MS	Number of obs	=	22
				F(4, 17)	=	37.32
Model	4.64569724	4	1.16142431	Prob > F	=	0.0000
Residual	.529104674	17	.031123804	R-squared	=	0.8978
				Adj R-squared	=	0.8737
Total	5.17480192	21	.246419139	Root MSE	=	.17642

lst	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lpx2	-.4503744	.1515961	-2.97	0.009	-.7702142	-.1305347
lpx3	-.9242052	.2783356	-3.32	0.004	-1.511442	-.3369685
lpx4	-.3883793	.4222332	-0.92	0.371	-1.279214	.5024549
lgdp	.3438812	.1913463	1.80	0.090	-.0598242	.7475865
_cons	24.65741	5.309757	4.64	0.000	13.4548	35.86002

```
13 . reg ldt lpx2 lpx3 lpx4 lgdp
```

Source	SS	df	MS	Number of obs	=	22
				F(4, 17)	=	26.43
Model	3.4026552	4	.850663799	Prob > F	=	0.0000
Residual	.54721789	17	.032189288	R-squared	=	0.8615
				Adj R-squared	=	0.8289
Total	3.94987309	21	.188089195	Root MSE	=	.17941

ldt	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lpx2	-.4887365	.1541691	-3.17	0.006	-.8140049	-.1634682
lpx3	-.7243134	.2830597	-2.56	0.020	-1.321517	-.1271097
lpx4	-.577921	.4293997	-1.35	0.196	-1.483875	.3280333
lgdp	.1265855	.194594	0.65	0.524	-.2839719	.5371429
_cons	27.18614	5.399879	5.03	0.000	15.79339	38.57889

```
14 . reg lpd lpx2 lpx3 lpx4 lgdp
```

Source	SS	df	MS	Number of obs	=	22
				F(4, 17)	=	6.76
Model	.17707359	4	.044268398	Prob > F	=	0.0019
Residual	.111247189	17	.006543952	R-squared	=	0.6142
				Adj R-squared	=	0.5234
Total	.288320779	21	.013729561	Root MSE	=	.08089

lpd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lpx2	.1318015	.0695123	1.90	0.075	-.0148567	.2784596
lpx3	.0939842	.127627	0.74	0.472	-.1752851	.3632535
lpx4	.4939641	.1936093	2.55	0.021	.0854842	.9024439
lgdp	.1632779	.0877392	1.86	0.080	-.0218357	.3483914
_cons	2.87652	2.434717	1.18	0.254	-2.260283	8.013322

```
15 . quietly reg lst lpx2 lpx3 lpx4 lgdp

16 . predict lsthat
   (option xb assumed; fitted values)

17 . quietly reg ldt lpx2 lpx3 lpx4 lgdp

18 .
19 .
20 . predict ldthat
   (option xb assumed; fitted values)

21 . quietly reg lpd lpx2 lpx3 lpx4 lgdp

22 . predict lpdhat
   (option xb assumed; fitted values)

23 . reg lpx2 lsthat ldthat lpdhat
```

Source	SS	df	MS	Number of obs	=	22
				F(3, 18)	=	523.00
Model	2.31080462	3	.770268206	Prob > F	=	0.0000
Residual	.026510047	18	.00147278	R-squared	=	0.9887
				Adj R-squared	=	0.9868
Total	2.33731467	21	.111300698	Root MSE	=	.03838

lpx2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lsthat	7.882244	.3538245	22.28	0.000	7.138886	8.625602
ldthat	-11.34949	.4859372	-23.36	0.000	-12.37041	-10.32858
lpdhat	-7.395525	.4092558	-18.07	0.000	-8.255339	-6.53571
_cons	134.0489	6.201205	21.62	0.000	121.0206	147.0771

```
24 . reg lpx3 lsthat ldthat lpdhat
```

Source	SS	df	MS	Number of obs	=	22
				F(3, 18)	=	30.54
Model	.767648444	3	.255882815	Prob > F	=	0.0000
Residual	.15081264	18	.00837848	R-squared	=	0.8358
				Adj R-squared	=	0.8084
Total	.918461084	21	.043736242	Root MSE	=	.09153

lpx3	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lsthat	-2.969866	.8439206	-3.52	0.002	-4.742877	-1.196854
ldthat	3.532088	1.159028	3.05	0.007	1.097061	5.967114
lpdhat	2.547322	.9761318	2.61	0.018	.4965449	4.598099
_cons	-26.74069	14.79073	-1.81	0.087	-57.81486	4.333488

```
25 . reg lpx4 lsthat ldthat lpdhat
```

Source	SS	df	MS	Number of obs	=	22
				F(3, 18)	=	85.28
Model	.700820625	3	.233606875	Prob > F	=	0.0000
Residual	.04930852	18	.002739362	R-squared	=	0.9343
				Adj R-squared	=	0.9233
Total	.750129145	21	.035720435	Root MSE	=	.05234

lpx4	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lsthat	-2.3835	.4825515	-4.94	0.000	-3.397303	-1.369697
ldthat	3.008628	.6627289	4.54	0.000	1.616286	4.40097
lpdhat	3.241577	.5581496	5.81	0.000	2.068948	4.414205
_cons	-34.27995	8.457301	-4.05	0.001	-52.04808	-16.51182

```
26 . reg lgdp lsthat ldthat lpdhat
```

Source	SS	df	MS	Number of obs	=	22
				F(3, 18)	=	50.76
Model	2.84277855	3	.947592851	Prob > F	=	0.0000
Residual	.33602584	18	.018668102	R-squared	=	0.8943
				Adj R-squared	=	0.8767
Total	3.17880439	21	.151371638	Root MSE	=	.13663

lgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lsthat	2.557554	1.259706	2.03	0.057	-.0889888	5.204097
ldthat	-1.973533	1.73006	-1.14	0.269	-5.608254	1.661189
lpdhat	.8213629	1.457055	0.56	0.580	-2.239796	3.882522
_cons	-6.725268	22.07787	-0.30	0.764	-53.10915	39.65861

```
27 . reg3 ( lst lpd lpx2 lpx3 lpx4 )( ldt lpd lgdp )

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lst	22	4	.14721	0.9079	216.45	0.0000
ldt	22	2	.1301146	0.9057	207.90	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lst						
lpd	-1.205282	.3949379	-3.05	0.002	-1.979346	-.4312178
lpx2	-.360095	.122307	-2.94	0.003	-.5998124	-.1203776
lpx3	-.8002308	.2205881	-3.63	0.000	-1.232576	-.367886
lpx4	-.654296	.2956558	-2.21	0.027	-1.233771	-.0748213
_cons	42.05618	3.211606	13.10	0.000	35.76154	48.35081
ldt						
lpd	-2.250455	.2733233	-8.23	0.000	-2.786159	-1.714751
lgdp	.5339629	.0817519	6.53	0.000	.3737321	.6941937
_cons	32.24346	3.48226	9.26	0.000	25.41836	39.06856

```
Endogenous variables:  lst ldt
Exogenous variables:   lpd lpx2 lpx3 lpx4 lgdp
```

```
28 . reg3 (lst lpd lpx2 lpx3 lpx4)(ldt lpd lgdp), ols

Multivariate regression
```

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
lst	22	4	.1652258	0.9103	43.14	0.0000
ldt	22	2	.1391259	0.9069	92.53	0.0000

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lst						
lpd	-1.111835	.4515147	-2.46	0.019	-2.027549	-.1961207
lpx2	-.4189546	.1431634	-2.93	0.006	-.7093034	-.1286059
lpx3	-.9424196	.2585266	-3.65	0.001	-1.466736	-.4181034
lpx4	-.521346	.3441643	-1.51	0.139	-1.219344	.1766516
_cons	41.4946	3.661911	11.33	0.000	34.0679	48.9213
ldt						
lpd	-2.181329	.2946999	-7.40	0.000	-2.779008	-1.58365
lgdp	.5776586	.0887536	6.51	0.000	.397658	.7576593
_cons	31.03578	3.761201	8.25	0.000	23.40771	38.66385

```
29 . reg3 (lst lpd lpx2 lpx3 lpx4)(ldt lpd lgdp), 2sls nodfk inst(lpx2 lpx3 lpx4 lgdp)

Two-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
lst	**22**	**4**	**.329951**	**0.6424**	**13.81**	**0.0000**
ldt	**22**	**2**	**.1454858**	**0.8982**	**89.20**	**0.0000**

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lst						
lpd	**2.10611**	**1.926677**	**1.09**	**0.282**	**-1.801371**	**6.013591**
lpx2	**-.7279628**	**.3026471**	**-2.41**	**0.021**	**-1.34176**	**-.114166**
lpx3	**-1.122146**	**.464304**	**-2.42**	**0.021**	**-2.063798**	**-.180494**
lpx4	**-1.428722**	**.7811544**	**-1.83**	**0.076**	**-3.012977**	**.1555325**
_cons	**18.59914**	**14.05113**	**1.32**	**0.194**	**-9.897873**	**47.09616**
ldt						
lpd	**-2.574157**	**.4046743**	**-6.36**	**0.000**	**-3.394875**	**-1.75344**
lgdp	**.5212921**	**.0955104**	**5.46**	**0.000**	**.327588**	**.7149961**
_cons	**35.93499**	**5.106302**	**7.04**	**0.000**	**25.57893**	**46.29105**

```
Endogenous variables:  lst lpd ldt
Exogenous variables:   lpx2 lpx3 lpx4 lgdp

30 . reg3 (lst lpd lpx2 lpx3 lpx4)(ldt lpd lgdp), 3sls nodfk inst(lpx2 lpx3 lpx4 lgdp)

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lst	**22**	**4**	**.2963642**	**0.6266**	**57.47**	**0.0000**
ldt	**22**	**2**	**.135203**	**0.8982**	**178.41**	**0.0000**

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lst						
lpd	**2.171576**	**1.926095**	**1.13**	**0.260**	**-1.603501**	**5.946652**
lpx2	**-.7990055**	**.2985983**	**-2.68**	**0.007**	**-1.384247**	**-.2137635**
lpx3	**-1.329743**	**.4560002**	**-2.92**	**0.004**	**-2.223487**	**-.4359989**
lpx4	**-1.171403**	**.775654**	**-1.51**	**0.131**	**-2.691657**	**.348851**
_cons	**17.84948**	**14.04122**	**1.27**	**0.204**	**-9.670808**	**45.36976**
ldt						
lpd	**-2.574157**	**.4046743**	**-6.36**	**0.000**	**-3.367304**	**-1.78101**
lgdp	**.5212921**	**.0955104**	**5.46**	**0.000**	**.3340951**	**.708489**
_cons	**35.93499**	**5.106302**	**7.04**	**0.000**	**25.92682**	**45.94316**

```
Endogenous variables:  lst lpd ldt
Exogenous variables:   lpx2 lpx3 lpx4 lgdp

31 . reg3 (lst lpd lpx2 lpx3 lpx4)(ldt lpd lgdp), 3sls ireg3 nodfk inst(lpx2 lpx3 lpx4 lgdp)

Iteration 1:   tolerance =   .1059484
Iteration 2:   tolerance =  .04569793
Iteration 3:   tolerance =  .01846611
Iteration 4:   tolerance =  .00725496
Iteration 5:   tolerance =  .00281814
Iteration 6:   tolerance =  .00108981
Iteration 7:   tolerance =  .00042072
Iteration 8:   tolerance =  .00016231
Iteration 9:   tolerance =   .0000626
Iteration 10:  tolerance =  .00002414
Iteration 11:  tolerance =  9.310e-06
Iteration 12:  tolerance =  3.590e-06
Iteration 13:  tolerance =  1.384e-06
Iteration 14:  tolerance =  5.339e-07
```

Three-stage least-squares regression, iterated

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lst	**22**	**4**	**.3022006**	**0.6117**	**54.83**	**0.0000**
ldt	**22**	**2**	**.135203**	**0.8982**	**178.41**	**0.0000**

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lst						
lpd	**2.212666**	**2.005956**	**1.10**	**0.270**	**-1.718936**	**6.144268**
lpx2	**-.8435967**	**.3049354**	**-2.77**	**0.006**	**-1.441259**	**-.2459342**
lpx3	**-1.460044**	**.4623671**	**-3.16**	**0.002**	**-2.366267**	**-.5538216**
lpx4	**-1.009892**	**.7998393**	**-1.26**	**0.207**	**-2.577548**	**.557764**
_cons	**17.37893**	**14.61488**	**1.19**	**0.234**	**-11.26571**	**46.02357**
ldt						
lpd	**-2.574157**	**.4046743**	**-6.36**	**0.000**	**-3.367304**	**-1.78101**
lgdp	**.5212921**	**.0955104**	**5.46**	**0.000**	**.3340951**	**.708489**
_cons	**35.93499**	**5.106302**	**7.04**	**0.000**	**25.92682**	**45.94316**

Endogenous variables: lst lpd ldt
Exogenous variables: lpx2 lpx3 lpx4 lgdp

```
32 .
33 .
34 . quietly reg3 (lst lpd lpx2 lpx3 lpx4)(ldt lpd lgdp), ols

35 . estimate store ols

36 . quietly reg3 (lst lpd lpx2 lpx3 lpx4)(ldt lpd lgdp), 2sls nodfk inst(lpx2 lpx3 lpx4 lgdp)

37 . estimate store twostage

38 . hausman twostage ols
```

	Coefficients (b) twostage	(B) ols	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lpd	**2.10611**	**-1.111835**	**3.217945**	**1.873023**
lpx2	**-.7279628**	**-.4189546**	**-.3090082**	**.266645**
lpx3	**-1.122146**	**-.9424196**	**-.1797266**	**.3856712**
lpx4	**-1.428722**	**-.521346**	**-.907376**	**.7012511**

b = consistent under Ho and Ha; obtained from reg3
B = inconsistent under Ha, efficient under Ho; obtained from reg3

Test: Ho: difference in coefficients not systematic

chi2(**4**) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= **2.95**
Prob>chi2 = **0.5659**

```
39 . quietly reg lst lpd lpx2 lpx3 lpx4

40 . estimate store ols1
```

```
41 . quietly reg3 ldt lpd lgdp

42 . estimate store twostage1

43 . hausman twostage1 ols1
   no coefficients in common; specify equations(matchlist)
   for problems with different equation names.
   r(498);

44 . quietly reg3 (lst lpd lpx2 lpx3 lpx4), 2sls nodfk inst(lpx2 lpx3 lpx4 lgdp)

45 . estimate store twostage1.1
   twostage1.1 invalid name
   r(7);

46 . estimate store twostage2

47 . hausman twostage2 ols1
   no coefficients in common; specify equations(matchlist)
   for problems with different equation names.
   r(498);

48 . quietly reg3 (lst lpd lpx2 lpx3 lpx4), 2sls

49 . estimate store twostage3

50 . hausman twostage3 ols1
   no coefficients in common; specify equations(matchlist)
   for problems with different equation names.
   r(498);

51 . quietly reg3 (lst lpd lpx2 lpx3 lpx4), ols

52 . estimate store happy

53 . hausman twostage3 happy

   Note: the rank of the differenced variance matrix (0) does not equal the number of coefficients
         being tested (4); be sure this is what you expect, or there may be problems computing
         the test.  Examine the output of your estimators for anything unexpected and possibly
         consider scaling your variables so that the coefficients are on a similar scale.

                    ---- Coefficients ----
                 |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                 |  twostage3      happy        Difference          S.E.
-----------------+------------------------------------------------------------
             lpd |  -1.111835   -1.111835               0               0
            lpx2 |  -.4189546   -.4189546               0               0
            lpx3 |  -.9424196   -.9424196               0               0
            lpx4 |   -.521346    -.521346               0               0
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from reg3
                B = inconsistent under Ha, efficient under Ho; obtained from reg3

    Test:  Ho:  difference in coefficients not systematic

                  chi2(0) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =         0.00
                Prob>chi2 =            .
                (V_b-V_B is not positive definite)

54 . gen qt=st if dt>st
   (22 missing values generated)
```

```
55 . replace qt=dt if st>dt
   (22 real changes made)

56 . gen lqt=ln(qt)

57 . reg3 (lqt lpd lpx2 lpx3 lpx4)(lqt lpd lgdp), ols

   Multivariate regression
```

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
lqt	**22**	**4**	**.136235**	**0.9201**	**48.95**	**0.0000**
2lqt	**22**	**2**	**.1391259**	**0.9069**	**92.53**	**0.0000**

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lqt						
lpd	**-1.353506**	**.3722912**	**-3.64**	**0.001**	**-2.108548**	**-.5984645**
lpx2	**-.3864994**	**.1180437**	**-3.27**	**0.002**	**-.6259031**	**-.1470957**
lpx3	**-.6782817**	**.2131651**	**-3.18**	**0.003**	**-1.110601**	**-.2459629**
lpx4	**-.3606189**	**.2837767**	**-1.27**	**0.212**	**-.9361448**	**.2149069**
_cons	**40.10218**	**3.019386**	**13.28**	**0.000**	**33.97858**	**46.22578**
2lqt						
lpd	**-2.181329**	**.2946999**	**-7.40**	**0.000**	**-2.779008**	**-1.58365**
lgdp	**.5776586**	**.0887536**	**6.51**	**0.000**	**.397658**	**.7576593**
_cons	**31.03578**	**3.761201**	**8.25**	**0.000**	**23.40771**	**38.66385**

```
58 . reg3 (lqt lpd lpx2 lpx3 lpx4)(lqt lpd lgdp), 2sls nodfk inst(lpx3 lpx4 lgdp)
   Equation is not identified -- does not meet order conditions
       Equation lqt:  lqt  lpd lpx2 lpx3 lpx4
       Exogenous variables:   lpx3 lpx4 lgdp
   r(481);

59 . reg3 (lqt lpd lpx2 lpx3 lpx4)(lqt lpd lgdp), 2sls nodfk inst(lpx2 lpx3 lpx4 lgdp)

   Two-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
lqt	**22**	**4**	**.2329302**	**0.7665**	**20.29**	**0.0000**
2lqt	**22**	**2**	**.1454858**	**0.8982**	**89.20**	**0.0000**

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lqt						
lpd	**.7752765**	**1.360145**	**0.57**	**0.572**	**-1.983225**	**3.533778**
lpx2	**-.5909191**	**.2136549**	**-2.77**	**0.009**	**-1.024231**	**-.1576068**
lpx3	**-.7971771**	**.3277773**	**-2.43**	**0.020**	**-1.46194**	**-.132414**
lpx4	**-.9608797**	**.551459**	**-1.74**	**0.090**	**-2.079291**	**.1575311**
_cons	**24.95604**	**9.919453**	**2.52**	**0.016**	**4.838457**	**45.07362**
2lqt						
lpd	**-2.574157**	**.4046743**	**-6.36**	**0.000**	**-3.394875**	**-1.75344**
lgdp	**.5212921**	**.0955104**	**5.46**	**0.000**	**.327588**	**.7149961**
_cons	**35.93499**	**5.106302**	**7.04**	**0.000**	**25.57893**	**46.29105**

```
Endogenous variables:  lqt lpd
Exogenous variables:   lpx2 lpx3 lpx4 lgdp
```

```
60 . reg3 (lqt lpd lpx2 lpx3 lpx4)(lqt lpd lgdp), 3sls inst(lpx2 lpx3 lpx4 lgdp)

Three-stage least-squares regression

Equation             Obs   Parms        RMSE    "R-sq"       chi2         P
lqt                   22       4    .2056595    0.7644      81.74    0.0000
2lqt                  22       2     .135203    0.8982     178.41    0.0000

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lqt          |
         lpd |    .7879239   1.360114     0.58   0.562    -1.877851    3.453699
        lpx2 |   -.6046439   .2134422    -2.83   0.005    -1.022983   -.1863049
        lpx3 |   -.8372831   .3273419    -2.56   0.011    -1.478861   -.1957047
        lpx4 |   -.9111679   .5511692    -1.65   0.098     -1.99144    .1691039
       _cons |    24.81121   9.918929     2.50   0.012     5.370467    44.25195
-------------+----------------------------------------------------------------
2lqt         |
         lpd |   -2.574157   .4046743    -6.36   0.000    -3.367304    -1.78101
        lgdp |    .5212921   .0955104     5.46   0.000     .3340951     .708489
       _cons |    35.93499   5.106302     7.04   0.000     25.92682    45.94316
------------------------------------------------------------------------------
Endogenous variables:  lqt lpd
Exogenous variables:   lpx2 lpx3 lpx4 lgdp

61 . reg3 (lqt lpd lpx2 lpx3 lpx4)(lqt lpd lgdp), 3sls ireg inst(lpx2 lpx3 lpx4 lgdp)

Iteration 1:   tolerance =  .02535182
Iteration 2:   tolerance =  .01003058
Iteration 3:   tolerance =  .00390723
Iteration 4:   tolerance =  .00151264
Iteration 5:   tolerance =  .00058419
Iteration 6:   tolerance =  .00022541
Iteration 7:   tolerance =  .00008694
Iteration 8:   tolerance =  .00003353
Iteration 9:   tolerance =  .00001293
Iteration 10:   tolerance =  4.986e-06
Iteration 11:   tolerance =  1.923e-06
Iteration 12:   tolerance =  7.415e-07

Three-stage least-squares regression, iterated

Equation             Obs   Parms        RMSE    "R-sq"       chi2         P
lqt                   22       4    .2063295    0.7629      80.89    0.0000
2lqt                  22       2     .135203    0.8982     178.41    0.0000

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lqt          |
         lpd |     .795862   1.370509     0.58   0.561    -1.890287    3.482011
        lpx2 |   -.6132584    .214736    -2.86   0.004    -1.034133   -.1923836
        lpx3 |   -.8624556   .3291486    -2.62   0.009    -1.507575   -.2173363
        lpx4 |   -.8799661   .5549316    -1.59   0.113    -1.967612    .2076798
       _cons |    24.72031   9.994251     2.47   0.013     5.131936    44.30868
-------------+----------------------------------------------------------------
2lqt         |
         lpd |   -2.574157   .4046743    -6.36   0.000    -3.367304    -1.78101
        lgdp |    .5212921   .0955104     5.46   0.000     .3340951     .708489
       _cons |    35.93499   5.106302     7.04   0.000     25.92682    45.94316
------------------------------------------------------------------------------
Endogenous variables:  lqt lpd
Exogenous variables:   lpx2 lpx3 lpx4 lgdp
```

```
62 . log close
      name:  <unnamed>
       log:  C:\Users\user\Documents\BE TU\BE Classwork\Year2\EE426\HW2\2.3.smcl
  log type:  smcl
 closed on:   3 Feb 2021, 22:27:25
-------------------------------------------------------------------------------

63 .
```

```
      name:  <unnamed>
       log:  C:\Users\user\Documents\BE TU\BE Classwork\Year2\EE426\HW2\25.smcl
  log type:  smcl
 opened on:   4 Feb 2021, 08:14:06

 1 . do "C:\Users\user\AppData\Local\Temp\STD102c_000000.tmp"

 2 . tsset
        time variable:  obs, 1986 to 2007
                delta:  1 unit

 3 . gen lst=ln(st)

 4 . gen ldt=ln(dt)

 5 . gen lpd=ln(pm+t)

 6 . gen lpx2=ln(px2)

 7 . gen lpx3=ln(px3)

 8 . gen lpx4=ln(px4)

 9 . gen lgdp=ln(gdp)

10 .
   end of do-file

11 . reg lst lpd lpx2 lpx3 lpx4

      Source |       SS           df       MS      Number of obs   =        22
-------------+----------------------------------   F(4, 17)        =     43.14
       Model |  4.71070935         4  1.17767734   Prob > F        =    0.0000
    Residual |  .464092568        17  .027299563   R-squared       =    0.9103
-------------+----------------------------------   Adj R-squared   =    0.8892
       Total |  5.17480192        21  .246419139   Root MSE        =    .16523

------------------------------------------------------------------------------
         lst |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lpd |  -1.111835   .4515147    -2.46   0.025    -2.064448   -.1592222
        lpx2 |  -.4189546   .1431634    -2.93   0.009    -.7210029   -.1169063
        lpx3 |  -.9424196   .2585266    -3.65   0.002    -1.487863   -.3969762
        lpx4 |   -.521346   .3441643    -1.51   0.148    -1.247469    .2047773
       _cons |    41.4946   3.661911    11.33   0.000     33.76865    49.22056
------------------------------------------------------------------------------

12 . reg ldt lpd lgdp

      Source |       SS           df       MS      Number of obs   =        22
-------------+----------------------------------   F(2, 19)        =     92.53
       Model |  3.58210899         2  1.79105449   Prob > F        =    0.0000
    Residual |  .367764099        19  .019356005   R-squared       =    0.9069
-------------+----------------------------------   Adj R-squared   =    0.8971
       Total |  3.94987309        21  .188089195   Root MSE        =    .13913

------------------------------------------------------------------------------
         ldt |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lpd |  -2.181329   .2946999    -7.40   0.000    -2.798143   -1.564515
        lgdp |   .5776586   .0887536     6.51   0.000     .3918952    .7634221
       _cons |   31.03578   3.761201     8.25   0.000      23.1635    38.90807
------------------------------------------------------------------------------
```

```
13 . quietly reg lst lpd lpx2 lpx3 lpx4

14 . predict u1hat
   (option xb assumed; fitted values)

15 . predict u1hat, resid
   variable u1hat already defined
   r(110);

16 . predict uhat1, resid

17 . quietly reg ldt lpd lgdp

18 . predict uhat2, resid

19 . corr uhat1 uhat2
   (obs=22)

             |    uhat1    uhat2
-------------+----------------------
       uhat1 |   1.0000
       uhat2 |   0.2422   1.0000


20 . log close
      name:  <unnamed>
       log:  C:\Users\user\Documents\BE TU\BE Classwork\Year2\EE426\HW2\25.smcl
  log type:  smcl
 closed on:   4 Feb 2021, 09:07:17
-------------------------------------------------------------------------------
```