Assignment 5

1. In the study of interest rate structure, the continuous time model can be specified as:

$$r_{t+\Delta t} - r_t = (\alpha + \beta r_t)\Delta t + \varepsilon_{t+\Delta t} \tag{1}$$

where: $E[\varepsilon_{t+\Delta t}] = 0$ and $E[\varepsilon_{t+\Delta t}^2] = \sigma^2 r_t^{2\gamma} \Delta t$

Then, the model can be transformed to be discrete time model by setting $\Delta t = 1$. The discrete time model can be stated as:

$$r_{t+1} - r_t = \Delta r_t = \alpha + \beta r_t + \varepsilon_{t+1} \tag{2}$$

where: $E[\varepsilon_{t+1}] = 0$ and $E[\varepsilon_{t+1}^2] = \sigma^2 r_t^{2\gamma}$

The above model consists of four parameters including $\alpha, \beta, \sigma^2, \gamma$. The model can be estimate using GMM. Four moment condition equations can be stated as:

Zero mean condition: $E(\varepsilon_{t+1}) = 0$

Orthogonality condition: $E(\varepsilon_{t+1} r_t) = 0$

Variance condition: $E(\varepsilon_{t+1}^2 - \sigma^2 r_t^{2\gamma}) = 0$

Zero covariance condition: $E\left(\left(\varepsilon_{t+1}^2 - \sigma^2 r_t^{2\gamma}\right) r_t\right) = 0$

The above model can be claimed as unrestricted model for other eight interest rate structure models which can be indicated as follows:

Model	α	β	σ^2	γ	
(1) Unrestricted					4 ✓
(2) Merton		0		0	7 reject H_0 ✓
(3) Vasicek				0	10 ✓
(4) CIR SR				0.5	13 ✓
(5) Dothan	0	0		1	16 ✓
(6) GBM	0			1	19 ✓
(7) Brennan & Schwartz				1	22 ✓
(8) CIR VR	0	0		1.5	25 ✓
(9) CEV	0				28 reject H_0 ✓

From the given data set (`assign5-1.dta`):

a. Estimate the interest rate structure models applying all 9 models using GMM. Also perform Overidentification Test. (Hint: command for generating $\Delta r_t = r_{t+1} - r_t$ is `gen dr=f.r-r`)

b. Determine the most appropriated model using Wald Test.

2. From the model:

$$y_i = \alpha + \beta x_i + u_i \tag{3}$$

where: y_i is dependent variable

x_i is explanatory variable

u_i is stochastic error term

$E(u_i) = 0$ but $E(x_i u_i) \neq 0$.

From the given data set (`assign5-2.dta`):

a. Estimate model (3) using OLS.
b. Based on z_1, z_2, z_3, z_4, determine the best set of instrumental variables, then, estimate model (3) using GMM.
c. Determine whether OLS estimated results in (a) or GMM estimated results in (b) is more appropriate using the Hansen's J chi2 statistic test.

1. In the study of interest rate structure, the continuous time model can be specified as:

$$r_{t+\Delta t} - r_t = (\alpha + \beta r_t)\Delta t + \varepsilon_{t+\Delta t} \tag{1}$$

where: $E[\varepsilon_{t+\Delta t}] = 0$ and $E[\varepsilon^2_{t+\Delta t}] = \sigma^2 r_t^{2\gamma}\Delta t$

Then, the model can be transformed to be discrete time model by setting $\Delta t = 1$. The discrete time model can be stated as:

$$\underbrace{r_{t+1} - r_t}_{y} = \Delta r_t \underbrace{=}_{=} \underbrace{\alpha + \beta r_t + \varepsilon_{t+1}}_{\alpha + \beta X_1 + u} \tag{2}$$

where: $E[\varepsilon_{t+1}] = 0$ and $E[\varepsilon^2_{t+1}] = \sigma^2 r_t^{2\gamma}$

The above model consists of four parameters including $\alpha, \beta, \sigma^2, \gamma$. The model can be estimate using GMM. Four moment condition equations can be stated as:

Zero mean condition:	$E(\varepsilon_{t+1}) = 0$
Orthogonality condition:	$E(\varepsilon_{t+1} r_t) = 0$
Variance condition:	$E(\varepsilon^2_{t+1} - \sigma^2 r_t^{2\gamma}) = 0$
Zero covariance condition:	$E\left(\left(\varepsilon^2_{t+1} - \sigma^2 r_t^{2\gamma}\right) r_t\right) = 0$

From the given data set (`assign5-1.dta`):

a. Estimate the interest rate structure models applying all 9 models using GMM. Also perform Overidentification Test. (Hint: command for generating $\Delta r_t = r_{t+1} - r_t$ is `gen dr=f.r-r`)

b. Determine the most appropriated model using Wald Test.

a) In stata

b) The most appropriated is Vasicek model with the highest P-value. It implies that the model is most useful.

2. From the model:

$$y_i = \alpha + \beta x_i + u_i \tag{3}$$

where: y_i is dependent variable

x_i is explanatory variable

u_i is stochastic error term

$E(u_i) = 0$ but $E(x_i u_i) \neq 0$.

From the given data set (`assign5-2.dta`):

a. Estimate model (3) using OLS.

b. Based on z_1, z_2, z_3, z_4, determine the best set of instrumental variables, then, estimate model (3) using GMM.

c. Determine whether OLS estimated results in (a) or GMM estimated results in (b) is more appropriate using the Hansen's J chi2 statistic test.

a) $y = -33.3133 + 5.431333\hat{x}$ //

b) The best set is $[z_2, z_4]$

c) P-value of gmm(z_2, z_4) = 0.1155

It fail to reject the null hypothesis.

```
  ___  ____  ____  ____  ____(R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/
  Statistics/Data Analysis
```

```
Iteration 3:   GMM criterion Q(b) =  1.604e-06
      name:  <unnamed>
       log:  C:\Users\Pongpanot\Downloads\ASS5_GMM_Q1.smcl
  log type:  smcl
 opened on:  24 Feb 2021, 01:31:38

1 . use "C:\Users\Pongpanot\Downloads\assign5-1.dta", clear

2 . gen dr=f.r-r
(1 missing value generated)

3 .  gmm (dr-{alpha}-{beta}*r) ((dr-{alpha}-{beta}*r)*r) ((dr-{alpha}-{beta}*r)^2-{sigma2}*r^(2*{gam
note: 1 missing value returned for equation 1 at initial values
note: 1 missing value returned for equation 2 at initial values
note: 1 missing value returned for equation 3 at initial values
note: 1 missing value returned for equation 4 at initial values

Step 1
numerical derivatives are approximate
flat or discontinuous region encountered
Iteration 0:   GMM criterion Q(b) =  .00001173
Iteration 1:   GMM criterion Q(b) =  8.321e-06  (backed up)
Iteration 2:   GMM criterion Q(b) =  6.043e-06  (not concave)
Iteration 3:   GMM criterion Q(b) =  1.604e-06
Iteration 4:   GMM criterion Q(b) =  1.662e-09
Iteration 5:   GMM criterion Q(b) =  1.344e-13

Step 2
Iteration 0:   GMM criterion Q(b) =  3.899e-10
Iteration 1:   GMM criterion Q(b) =  4.098e-18

note: model is exactly identified

GMM estimation

Number of parameters =   4
Number of moments    =   4
Initial weight matrix: Identity                  Number of obs   =      1,334
GMM weight matrix:     Robust
```

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
/alpha	-.0023725	.0011574	-2.05	0.040	-.0046409	-.0001041
/beta	.0004291	.0002873	1.49	0.135	-.000134	.0009922
/sigma2	.0005043	.000324	1.56	0.120	-.0001307	.0011393
/gamma	.0985177	.1823933	0.54	0.589	-.2589666	.456002

```
Instruments for equation 1: _cons
Instruments for equation 2: _cons
Instruments for equation 3: _cons
Instruments for equation 4: _cons

4 . estat overid

  Test of overidentifying restriction:

  Hansen's J chi2(0) = 5.5e-15 (p =     .)

Note: test cannot be performed because there are no
      overidentifying restrictions.
```

```
5 . est store unrestricted

6 . gmm (dr-{alpha}) ((dr-{alpha})*r) ((dr-{alpha})^2-{sigma2}) (((dr-{alpha})^2-{sigma2})*r) winiti
  note: 1 missing value returned for equation 1 at initial values
  note: 1 missing value returned for equation 2 at initial values
  note: 1 missing value returned for equation 3 at initial values
  note: 1 missing value returned for equation 4 at initial values

  Step 1
  Iteration 0:   GMM criterion Q(b) =  .00001173
  Iteration 1:   GMM criterion Q(b) =  4.045e-08
  Iteration 2:   GMM criterion Q(b) =  4.044e-08

  Step 2
  Iteration 0:   GMM criterion Q(b) =  .00798141
  Iteration 1:   GMM criterion Q(b) =  .00552368
  Iteration 2:   GMM criterion Q(b) =  .00552368

  GMM estimation

  Number of parameters =   2
  Number of moments    =   4
  Initial weight matrix: Identity                   Number of obs   =      1,334
  GMM weight matrix:     Robust

  ------------------------------------------------------------------------------
               |               Robust
               |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
        /alpha |  -.0008137   .0006821    -1.19   0.233    -.0021507    .0005232
       /sigma2 |   .0004277   .0002902     1.47   0.141    -.0001412    .0009965
  ------------------------------------------------------------------------------
  Instruments for equation 1: _cons
  Instruments for equation 2: _cons
  Instruments for equation 3: _cons
  Instruments for equation 4: _cons

7 . estat overid

    Test of overidentifying restriction:

    Hansen's J chi2(2) = 7.36859 (p = 0.0251)

8 . est store Merton

9 . gmm (dr-{alpha}-{beta}*r) ((dr-{alpha}-{beta}*r)*r) ((dr-{alpha}-{beta}*r)^2-{sigma2}) (((dr-{al
  note: 1 missing value returned for equation 1 at initial values
  note: 1 missing value returned for equation 2 at initial values
  note: 1 missing value returned for equation 3 at initial values
  note: 1 missing value returned for equation 4 at initial values

  Step 1
  Iteration 0:   GMM criterion Q(b) =  .00001173
  Iteration 1:   GMM criterion Q(b) =  3.336e-10
  Iteration 2:   GMM criterion Q(b) =  3.273e-10

  Step 2
  Iteration 0:   GMM criterion Q(b) =  .00063051
  Iteration 1:   GMM criterion Q(b) =  .00020488
  Iteration 2:   GMM criterion Q(b) =  .00020488

  GMM estimation
```

```
Number of parameters =   3
Number of moments    =   4
Initial weight matrix: Identity                 Number of obs   =      1,334
GMM weight matrix:     Robust
```

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
/alpha	-.0026994	.0009734	-2.77	0.006	-.0046072	-.0007915
/beta	.0005368	.0001999	2.69	0.007	.000145	.0009286
/sigma2	.0005887	.0002977	1.98	0.048	5.20e-06	.0011722

```
Instruments for equation 1: _cons
Instruments for equation 2: _cons
Instruments for equation 3: _cons
Instruments for equation 4: _cons

10 . estat overid

  Test of overidentifying restriction:

  Hansen's J chi2(1) = .273315 (p = 0.6011)

11 . est store Vasicek

12 .  gmm (dr-{alpha}-{beta}*r) ((dr-{alpha}-{beta}*r)*r) ((dr-{alpha}-{beta}*r)^2-{sigma2}*r) (((dr-
note: 1 missing value returned for equation 1 at initial values
note: 1 missing value returned for equation 2 at initial values
note: 1 missing value returned for equation 3 at initial values
note: 1 missing value returned for equation 4 at initial values

Final GMM criterion Q(b) =   .001642

GMM estimation

Number of parameters =   3
Number of moments    =   4
Initial weight matrix: Identity                 Number of obs   =      1,334
GMM weight matrix:     Robust
```

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
/alpha	-.0010252	.0007112	-1.44	0.149	-.0024191	.0003686
/beta	.0002288	.0002532	0.90	0.366	-.0002675	.000725
/sigma2	.0000917	.0000646	1.42	0.156	-.000035	.0002183

```
Instruments for equation 1: _cons
Instruments for equation 2: _cons
Instruments for equation 3: _cons
Instruments for equation 4: _cons

13 . estat overid

  Test of overidentifying restriction:

  Hansen's J chi2(1) = 2.19038 (p = 0.1389)
```

```
14 . est store CIR_SR

15 .  gmm (dr) (dr*r) ((dr)^2-{sigma2}*r^2) (((dr)^2-{sigma2}*r^2)*r) winitial(identity)
   note: no parameters in equation 1
   note: no parameters in equation 2
   note: 1 missing value returned for equation 1 at initial values
   note: 1 missing value returned for equation 2 at initial values
   note: 1 missing value returned for equation 3 at initial values
   note: 1 missing value returned for equation 4 at initial values

   Step 1
   Iteration 0:   GMM criterion Q(b) =  .00001173
   Iteration 1:   GMM criterion Q(b) =  5.688e-06
   Iteration 2:   GMM criterion Q(b) =  5.688e-06

   Step 2
   Iteration 0:   GMM criterion Q(b) =  .00932249
   Iteration 1:   GMM criterion Q(b) =  .00344401
   Iteration 2:   GMM criterion Q(b) =  .00344401

   GMM estimation

   Number of parameters =   1
   Number of moments    =   4
   Initial weight matrix: Identity                   Number of obs   =      1,334
   GMM weight matrix:     Robust
```

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
/sigma2	.0000162	7.20e-06	2.25	0.025	2.08e-06	.0000303

```
   Instruments for equation 1: _cons
   Instruments for equation 2: _cons
   Instruments for equation 3: _cons
   Instruments for equation 4: _cons

16 . estat overid

     Test of overidentifying restriction:

     Hansen's J chi2(3) = 4.59432 (p = 0.2040)

17 . est store Dothan

18 .  gmm (dr-{beta}*r) ((dr-{beta}*r)*r) ((dr-{beta}*r)^2-{sigma2}*r^2) (((dr-{beta}*r)^2-{sigma2}*r
   note: 1 missing value returned for equation 1 at initial values
   note: 1 missing value returned for equation 2 at initial values
   note: 1 missing value returned for equation 3 at initial values
   note: 1 missing value returned for equation 4 at initial values

   Step 1
   Iteration 0:   GMM criterion Q(b) =  .00001173
   Iteration 1:   GMM criterion Q(b) =  8.547e-08
   Iteration 2:   GMM criterion Q(b) =  8.547e-08

   Step 2
   Iteration 0:   GMM criterion Q(b) =   .0082543
   Iteration 1:   GMM criterion Q(b) =  .00342544
   Iteration 2:   GMM criterion Q(b) =  .00342542

   GMM estimation
```

```
Number of parameters =   2
Number of moments    =   4
Initial weight matrix: Identity                   Number of obs   =      1,334
GMM weight matrix:     Robust

------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       /beta |   .0000248   .0001265     0.20   0.844     -.000223    .0002727
     /sigma2 |   .0000154   8.33e-06     1.84   0.065    -9.60e-07    .0000317
------------------------------------------------------------------------------
Instruments for equation 1: _cons
Instruments for equation 2: _cons
Instruments for equation 3: _cons
Instruments for equation 4: _cons

19 . estat overid

  Test of overidentifying restriction:

  Hansen's J chi2(2) = 4.56951 (p = 0.1018)

20 . est store GBM

21 .  gmm (dr-{alpha}-{beta}*r) ((dr-{alpha}-{beta}*r)*r) ((dr-{alpha}-{beta}*r)^2-{sigma2}*r^2) (((d
note: 1 missing value returned for equation 1 at initial values
note: 1 missing value returned for equation 2 at initial values
note: 1 missing value returned for equation 3 at initial values
note: 1 missing value returned for equation 4 at initial values

Step 1
Iteration 0:   GMM criterion Q(b) =  .00001173
Iteration 1:   GMM criterion Q(b) =  1.062e-08
Iteration 2:   GMM criterion Q(b) =  1.061e-08

Step 2
Iteration 0:   GMM criterion Q(b) =   .0202404
Iteration 1:   GMM criterion Q(b) =  .00259237
Iteration 2:   GMM criterion Q(b) =  .00259234

GMM estimation

Number of parameters =   3
Number of moments    =   4
Initial weight matrix: Identity                   Number of obs   =      1,334
GMM weight matrix:     Robust

------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      /alpha |  -.0008979   .0008413    -1.07   0.286    -.0025469     .000751
       /beta |   .0002882   .0002774     1.04   0.299    -.0002555    .0008319
     /sigma2 |   8.91e-06   .0000103     0.87   0.387    -.0000113    .0000291
------------------------------------------------------------------------------
Instruments for equation 1: _cons
Instruments for equation 2: _cons
Instruments for equation 3: _cons
Instruments for equation 4: _cons
```

```
22 . estat overid

  Test of overidentifying restriction:

  Hansen's J chi2(1) = 3.45819 (p = 0.0629)

23 . est store Brennan_Schwartz

24 .  gmm (dr) (dr*r) (dr^2-{sigma2}*r^3) (((dr)^2-{sigma2}*r^3)*r) winitial(identity)
note: no parameters in equation 1
note: no parameters in equation 2
note: 1 missing value returned for equation 1 at initial values
note: 1 missing value returned for equation 2 at initial values
note: 1 missing value returned for equation 3 at initial values
note: 1 missing value returned for equation 4 at initial values

Step 1
Iteration 0:   GMM criterion Q(b) =  .00001173
Iteration 1:   GMM criterion Q(b) =  5.694e-06
Iteration 2:   GMM criterion Q(b) =  5.694e-06

Step 2
Iteration 0:   GMM criterion Q(b) =  .01561186
Iteration 1:   GMM criterion Q(b) =   .0038055
Iteration 2:   GMM criterion Q(b) =   .0038055

GMM estimation

Number of parameters =   1
Number of moments    =   4
Initial weight matrix: Identity                   Number of obs   =      1,334
GMM weight matrix:     Robust
```

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
/sigma2	2.70e-06	1.26e-06	2.15	0.032	2.35e-07	5.16e-06

```
Instruments for equation 1: _cons
Instruments for equation 2: _cons
Instruments for equation 3: _cons
Instruments for equation 4: _cons

25 . estat overid

  Test of overidentifying restriction:

  Hansen's J chi2(3) = 5.07654 (p = 0.1663)

26 . est store CIR_VR

27 .  gmm (dr-{beta}*r) ((dr-{beta}*r)*r) ((dr-{beta}*r)^2-{sigma2}*r^(2*{gamma})) (((dr-{beta}*r)^2-
note: 1 missing value returned for equation 1 at initial values
note: 1 missing value returned for equation 2 at initial values
note: 1 missing value returned for equation 3 at initial values
note: 1 missing value returned for equation 4 at initial values

Step 1
numerical derivatives are approximate
flat or discontinuous region encountered
Iteration 0:   GMM criterion Q(b) =  .00001173
Iteration 1:   GMM criterion Q(b) =  8.627e-06  (backed up)
Iteration 2:   GMM criterion Q(b) =  6.127e-06  (not concave)
Iteration 3:   GMM criterion Q(b) =  5.400e-06  (backed up)
Iteration 4:   GMM criterion Q(b) =  5.310e-06
```

```
Step 2
Iteration 0:   GMM criterion Q(b) =  .01236133
Iteration 1:   GMM criterion Q(b) =  .01075751
Iteration 2:   GMM criterion Q(b) =  .00760436
Iteration 3:   GMM criterion Q(b) =  .00678694
Iteration 4:   GMM criterion Q(b) =  .00326882
Iteration 5:   GMM criterion Q(b) =  .00316225
Iteration 6:   GMM criterion Q(b) =  .00313882
Iteration 7:   GMM criterion Q(b) =   .0031388

GMM estimation

Number of parameters =   3
Number of moments    =   4
Initial weight matrix: Identity                   Number of obs   =      1,334
GMM weight matrix:     Robust
```

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
/beta	-.0000453	.0001702	-0.27	0.790	-.0003789	.0002883
/sigma2	.0000881	.0001436	0.61	0.539	-.0001933	.0003696
/gamma	.5717551	.3668112	1.56	0.119	-.1471817	1.290692

```
Instruments for equation 1: _cons
Instruments for equation 2: _cons
Instruments for equation 3: _cons
Instruments for equation 4: _cons

28 . estat overid

  Test of overidentifying restriction:

  Hansen's J chi2(1) = 4.18715 (p = 0.0407)

29 . est store CEV

30 . est table unrestricted Merton Vasicek CIR_SR Dothan GBM Brennan_Schwartz CIR_VR CEV, star(0.1 0.
```

Variable	unrestricted	Merton	Vasicek	CIR_SR
alpha				
_cons	-.00237253**	-.00081372	-.00269937***	-.00102525
beta				
_cons	.00042912		.00053681***	.00022877
sigma2				
_cons	.00050427	.00042766	.00058872**	.00009168
gamma				
_cons	.09851773			

legend: * p<.1; ** p<.05; *** p<.01

Variable	Dothan	GBM	Brennan_Sch~z	CIR_VR
alpha				
_cons			**-.00089794**	
beta				
_cons		**.00002483**	**.0002882**	
sigma2				
_cons	**.00001618****	**.00001536***	**8.909e-06**	**2.698e-06****
gamma				
_cons				

legend: * p<.1; ** p<.05; *** p<.01

Variable	CEV
alpha	
_cons	
beta	
_cons	**-.00004534**
sigma2	
_cons	**.00008815**
gamma	
_cons	**.57175507**

legend: * p<.1; ** p<.05; *** p<.01

```
31 . *Wald test

32 . est restore unrestricted
   (results unrestricted are active now)

33 . *test unrestricted vs Merton

34 . test (_b[/beta]=0) (_b[/gamma]=0)
   command test is unrecognized
   r(199);

35 . test (_b[/beta]=0) (_b[/gamma]=0)
   command test is unrecognized
   r(199);

36 .  *test unrestricted vs Merton

37 .
38 . test (_b[/beta]=0) (_b[/gamma]=0)
   command test is unrecognized
   r(199);
```

```
37 . ivregress dr r
   dr not a valid estimator
   r(198);

38 . ivregress dr (r=z)
   dr not a valid estimator
   r(198);

39 . ivregress gmm dr r

   Instrumental variables (GMM) regression          Number of obs   =      1,334
                                                    Wald chi2(1)    =       2.23
                                                    Prob > chi2     =     0.1353
                                                    R-squared       =     0.0005
   GMM weight matrix: Robust                        Root MSE        =     .02532
```

dr	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
r	.0004291	.0002873	1.49	0.135	-.000134	.0009922
_cons	-.0023725	.0011574	-2.05	0.040	-.0046409	-.0001041

```
   (no endogenous regressors)

40 .  ivregress gmm dr (r=z)
   variable z not found
   r(111);

41 . reg dr r, vce(gmm)
   vcetype 'gmm' not allowed
   r(198);

42 . ivregress dr (r=r)
   dr not a valid estimator
   r(198);

43 . gen dr=f.r-r
   variable dr already defined
   r(110);

44 . *test unrestricted vs merton

45 . test (_b[/beta]=0) (_b[/gamma]=0)
   equation beta not found
   r(111);

46 . *Wald test

47 . est restore unrestricted
   (results unrestricted are active now)

48 . *test unrestricted vs Merton

49 .
```

```
50 .
51 . test (_b[/beta]=0) (_b[/gamma]=0)

    ( 1)  [beta]_cons = 0
    ( 2)  [gamma]_cons = 0

              chi2(  2) =    7.92
            Prob > chi2 =    0.0191

52 . *test unrestricted vs Vasicek

53 . test (_b[/gamma]=0)

    ( 1)  [gamma]_cons = 0

              chi2(  1) =    0.29
            Prob > chi2 =    0.5891

54 . test unrestricted vs CIR_SR
   unrestricted not found
   r(111);

55 .  *test unrestricted vs CIR_SR

56 . test (_b[/gamma]=0.5)

    ( 1)  [gamma]_cons = .5

              chi2(  1) =    4.85
            Prob > chi2 =    0.0277

57 . *test unrestricted vs Dothan

58 . test (_b[/alpha]=0) (_b[/beta]=0) (_b[/gamma]=1)

    ( 1)  [alpha]_cons = 0
    ( 2)  [beta]_cons = 0
    ( 3)  [gamma]_cons = 1

              chi2(  3) =   34.04
            Prob > chi2 =    0.0000

59 . *test unrestricted vs GBM

60 . test (_b[/alpha]=0) (_b[/gamma]=1)

    ( 1)  [alpha]_cons = 0
    ( 2)  [gamma]_cons = 1

              chi2(  2) =   27.48
            Prob > chi2 =    0.0000

61 . *test unrestricted vs Brennan_Schwartz

62 . test (_b[/gamma]=1)

    ( 1)  [gamma]_cons = 1

              chi2(  1) =   24.43
            Prob > chi2 =    0.0000
```

```
63 .  test (_b[/alpha]=0) (_b[/beta]=0) (_b[/gamma]=1.5)

 ( 1)  [alpha]_cons = 0
 ( 2)  [beta]_cons = 0
 ( 3)  [gamma]_cons = 1.5

           chi2(  3) =   95.71
         Prob > chi2 =    0.0000

64 .
65 .
66 . *test unrestricted vs CEV

67 . test (_b[/alpha]=0)

 ( 1)  [alpha]_cons = 0

           chi2(  1) =    4.20
         Prob > chi2 =    0.0404

68 . log close
      name:  <unnamed>
       log:  C:\Users\Pongpanot\Downloads\ASS5_GMM.smcl
  log type:  smcl
 closed on:  24 Feb 2021, 02:13:32
```

```
  ___  ____  ____  ____  ____(R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/
  Statistics/Data Analysis
```

```
      name:  <unnamed>
       log:  C:\Users\Pongpanot\Downloads\ASS5_GMM_Q2.smcl
  log type:  smcl
 opened on:  24 Feb 2021, 17:51:39
```

```
1 . use "C:\Users\Pongpanot\Downloads\assign5-2.dta", clear

2 . reg y x
```

Source	SS	df	MS
Model	132481.702	1	132481.702
Residual	146722.774	498	294.624043
Total	279204.475	499	559.528007

Number of obs	=	500
F(1, 498)	=	449.66
Prob > F	=	0.0000
R-squared	=	0.4745
Adj R-squared	=	0.4734
Root MSE	=	17.165

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
x	5.431333	.2561312	21.21	0.000	4.928102	5.934564
_cons	-33.31333	2.673868	-12.46	0.000	-38.56678	-28.05988

```
3 .  ivregress gmm y (x=z1 z2)
```

Instrumental variables (GMM) regression

GMM weight matrix: Robust

Number of obs	=	500
Wald chi2(1)	=	36.13
Prob > chi2	=	0.0000
R-squared	=	0.3136
Root MSE	=	19.577

y	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
x	2.269419	.3775527	6.01	0.000	1.529429	3.009409
_cons	-1.848121	3.763999	-0.49	0.623	-9.225423	5.529182

Instrumented: x
Instruments: z1 z2

```
4 .  ivregress gmm y (x=z1 z3)
```

Instrumental variables (GMM) regression

GMM weight matrix: Robust

Number of obs	=	500
Wald chi2(1)	=	412.16
Prob > chi2	=	0.0000
R-squared	=	0.4692
Root MSE	=	17.217

y	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
x	5.902412	.2907357	20.30	0.000	5.332581	6.472244
_cons	-37.03774	3.094795	-11.97	0.000	-43.10343	-30.97206

Instrumented: x
Instruments: z1 z3

```
5 .  ivregress gmm y (x=z1 z4)

  Instrumental variables (GMM) regression          Number of obs   =        500
                                                   Wald chi2(1)    =      40.88
                                                   Prob > chi2     =     0.0000
                                                   R-squared       =     0.3031
  GMM weight matrix: Robust                        Root MSE        =     19.727

  ------------------------------------------------------------------------------
               |               Robust
             y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
             x |   2.167043   .3389432     6.39   0.000     1.502726    2.831359
         _cons |  -.6716121   3.395567    -0.20   0.843    -7.326801    5.983577
  ------------------------------------------------------------------------------
  Instrumented:  x
  Instruments:   z1 z4

6 .  ivregress gmm y (x=z2 z3)

  Instrumental variables (GMM) regression          Number of obs   =        500
                                                   Wald chi2(1)    =     336.01
                                                   Prob > chi2     =     0.0000
                                                   R-squared       =          .
  GMM weight matrix: Robust                        Root MSE        =     26.192

  ------------------------------------------------------------------------------
               |               Robust
             y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
             x |   12.04153   .6569059    18.33   0.000     10.75402    13.32904
         _cons |  -99.72932   6.694597   -14.90   0.000    -112.8505   -86.60815
  ------------------------------------------------------------------------------
  Instrumented:  x
  Instruments:   z2 z3

7 .  ivregress gmm y (x=z2 z4)

  Instrumental variables (GMM) regression          Number of obs   =        500
                                                   Wald chi2(1)    =      33.24
                                                   Prob > chi2     =     0.0000
                                                   R-squared       =     0.3176
  GMM weight matrix: Robust                        Root MSE        =     19.521

  ------------------------------------------------------------------------------
               |               Robust
             y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
             x |   2.308142   .4003308     5.77   0.000     1.523508    3.092776
         _cons |  -2.231979   3.988067    -0.56   0.576    -10.04845    5.584488
  ------------------------------------------------------------------------------
  Instrumented:  x
  Instruments:   z2 z4

8 .  ivregress gmm y (x=z3 z4)

  Instrumental variables (GMM) regression          Number of obs   =        500
                                                   Wald chi2(1)    =     457.33
                                                   Prob > chi2     =     0.0000
                                                   R-squared       =     0.4615
  GMM weight matrix: Robust                        Root MSE        =     17.341
```

y	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
x	**6.237532**	**.2916741**	**21.39**	**0.000**	**5.665861**	**6.809202**
_cons	**-40.18052**	**3.069851**	**-13.09**	**0.000**	**-46.19731**	**-34.16372**

Instrumented: x
Instruments: z3 z4

9 . estat overid

Test of overidentifying restriction:

Hansen's J chi2(**1**) = **148.756** (p = **0.0000**)

10 . ivregress gmm y (x=z2 z4)

Instrumental variables (GMM) regression

Number of obs	=	**500**
Wald chi2(**1**)	=	**33.24**
Prob > chi2	=	**0.0000**
R-squared	=	**0.3176**
Root MSE	=	**19.521**

GMM weight matrix: Robust

y	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
x	**2.308142**	**.4003308**	**5.77**	**0.000**	**1.523508**	**3.092776**
_cons	**-2.231979**	**3.988067**	**-0.56**	**0.576**	**-10.04845**	**5.584488**

Instrumented: x
Instruments: z2 z4

11 . estat overid

Test of overidentifying restriction:

Hansen's J chi2(**1**) = **2.47701** (p = **0.1155**)

12 . log close
name: **<unnamed>**
log: **C:\Users\Pongpanot\Downloads\ASS5_GMM_Q2.smcl**
log type: **smcl**
closed on: **24 Feb 2021, 22:09:15**