```
Iteration 354:  residual SS =  9.32e+18
Iteration 355:  residual SS =  9.27e+18
Iteration 356:  residual SS =  9.27e+18
Iteration 357:  residual SS =  9.27e+18
```

Source	SS	df	MS		
Model	2.363e+20	4	5.9080e+19	Number of obs =	800
Residual	9.271e+18	796	1.1647e+16	R-squared =	0.9622
				Adj R-squared =	0.9621
Total	2.456e+20	800	3.0699e+17	Root MSE =	1.08e+08
				Res. dev. =	31861.36

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/b1	2.89e-17	6.45e-17	0.45	0.654	-9.77e-17	1.55e-16
/b2	.801761	.0319332	25.11	0.000	.7390776	.8644443
/b3	-1.88296	.2889716	-6.52	0.000	-2.450197	-1.315724
/b4	3.39589	.1261607	26.92	0.000	3.148243	3.643537

```
. test (_b[/b2]=0) (_b[/b3]=0) (_b[/b4]=0)

 ( 1)  [b2]_cons = 0
 ( 2)  [b3]_cons = 0
 ( 3)  [b4]_cons = 0

       F(  3,   796) = 7383.35
            Prob > F =    0.0000
```

a) $\hat{\gamma} = 2.89 \times 10^{-17}$

$\hat{\delta} = 0.80176$

$\hat{\rho} = -1.883$

$\hat{v} = 3.396$

$\hat{\sigma} = \frac{1}{1-\rho} = 0.347$

$(\text{prob} > F) < \alpha = 0.05$

$\therefore$ H_0 is rejected at 5% level

b)

```
Iteration 15:  residual SS =  819.9925
Iteration 16:  residual SS =  819.9925
```

Source	SS	df	MS		
Model	976.20485	3	325.401616	Number of obs =	800
Residual	819.99246	796	1.03014129	R-squared =	0.5435
				Adj R-squared =	0.5418
Total	1796.1973	799	2.24805671	Root MSE =	1.014959
				Res. dev. =	2290.048

lny	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/lnb1	3.798801	.4234183	8.97	0.000	2.967652	4.629949
/b4	.9727292	.0317774	30.61	0.000	.9103518	1.035107
/b3	-.8079827	.2186238	-3.70	0.000	-1.23713	-.3788354
/b2	.2351025	.0328464	7.16	0.000	.1706266	.2995784

```
. test (_b[/b2]=0) (_b[/b3]=0) (_b[/b4]=0)

 ( 1)  [b2]_cons = 0
 ( 2)  [b3]_cons = 0
 ( 3)  [b4]_cons = 0

       F(  3,   796) =  366.55
            Prob > F =    0.0000
```

$\ln \hat{\gamma} = 3.8$

$\hat{\delta} = 0.2351$

$\hat{\rho} = -0.808$

$\hat{v} = 0.97293$

$\hat{\sigma} = 0.553$

$(\text{prob} > F) < \alpha = 0.05$

$\therefore$ H_0 is rejected at 5% level

c) The different in initial value will reflect in the different value of each estimator.

```
Iteration 18:  residual SS =  1.35e+20
Iteration 19:  residual SS =  1.35e+20
```

Source	SS	df	MS		
Model	1.105e+20	4	2.7613e+19	Number of obs =	800
Residual	1.351e+20	796	1.6977e+17	R-squared =	0.4497
				Adj R-squared =	0.4470
Total	2.456e+20	800	3.0699e+17	Root MSE =	4.12e+08
				Res. dev. =	34004.87

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/b1	15.20637	9.357021	1.63	0.105	-3.160981	33.57372
/b2	.0547786	2.018277	0.03	0.978	-3.906995	4.016552
/b3	-38.85704	533.1722	-0.07	0.942	-1085.447	1007.733
/b4	1.063633	.0348958	30.48	0.000	.9951345	1.132132

From the change in initial value of γ_0 from 4 → 55 will all change the estimator result

$\hat{\gamma}$ chang from 2.89×10^{-17} → 15.206

$\hat{\beta}$, $\hat{\delta}$, $\hat{v}$, and $\hat{\sigma}$ all change.

d) The change of convergence value is like a change of relax on estimator result, the more convergence make estimator more relax in convert to be initial value which can also make the more error on estimator. The higher RSS of (i) than (ii) is one of the evidence that error is increase.

The constraint of iteration make estimation method less efficient (from a) → iteration → 359, but in d was limit at 100) due to the proceed was not finish yet but have to stop from the limitation, Sometime it make $\hat{\theta} \neq \theta_0$ → Intrinsic value

(i)

```
. nl ( y = {b1}*({b2}*k^(-{b3})+(1-{b2})*l^(-{b3}))^(-({b4}/{b3}))), init( b1 4 b2 0 b3 -1 b4 1) eps(1e-1)
(obs = 800)

Iteration 0:  residual SS =  2.35e+20
Iteration 1:  residual SS =  2.35e+20
```

Source	SS	df	MS		
Model	1.043e+19	4	2.6070e+18	Number of obs =	800
Residual	2.352e+20	796	2.9543e+17	R-squared =	0.0425
				Adj R-squared =	0.0376
Total	2.456e+20	800	3.0699e+17	Root MSE =	5.44e+08
				Res. dev. =	34448.06

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/b1	4.000008	15.18432	0.26	0.792	-25.80603	33.80605
/b2	1.29e-07	.0001603	0.00	0.999	-.0003145	.0003148
/b3	-29.0199	2406.782	-0.01	0.990	-4753.41	4695.371
/b4	1	.2148918	4.65	0.000	.5781783	1.421822

(ii)

```
Iteration 96:  residual SS =  2.35e+20
Iteration 97:  residual SS =  2.35e+20
Iteration 98:  residual SS =  2.35e+20
Iteration 99:  residual SS =  2.35e+20
```

Source	SS	df	MS		
Model	1.044e+19	4	2.6109e+18	Number of obs =	800
Residual	2.351e+20	796	2.9541e+17	R-squared =	0.0425
				Adj R-squared =	0.0377
Total	2.456e+20	800	3.0699e+17	Root MSE =	5.44e+08
				Res. dev. =	34448.01

y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/b1	4.002508	14.7236	0.27	0.786	-24.89917	32.90419
/b2	.0000247	.007176	0.00	0.997	-.0140615	.0141109
/b3	-19.1599	594.6246	-0.03	0.974	-1186.378	1148.058
/b4	.9999954	.2082142	4.80	0.000	.5912816	1.408709

```
convergence not achieved
r(430);
```

e)

```
Iteration 21:  residual SS =  819.9925
Iteration 22:  residual SS =  819.9925
```

Source	SS	df	MS		
Model	976.20485	3	325.401616	Number of obs =	800
Residual	819.99246	796	1.03014129	R-squared =	0.5435
				Adj R-squared =	0.5418
				Root MSE =	1.014959
Total	1796.1973	799	2.24805671	Res. dev. =	2290.048

lny	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/lnb1	3.7988	.4234183	8.97	0.000	2.967652	4.629949
/b4	.9727292	.0317774	30.61	0.000	.9103518	1.035107
/b3	-.8079832	.2186233	-3.70	0.000	-1.237129	-.3788369
/b2	.2351025	.0328464	7.16	0.000	.1706267	.2995783

```
Parameter lnb1 taken as constant term in model & ANOVA table
```

from the change of $\ln \gamma$ from $4 \to 55$ won't change in $\ln \hat{\gamma}$ due to $\ln(55) \approx 4$

f)

(i)

```
Iteration 10:  residual SS =  820.4592
Iteration 11:  residual SS =  819.9926
```

Source	SS	df	MS		
Model	976.20472	3	325.401572	Number of obs =	800
Residual	819.9926	796	1.03014145	R-squared =	0.5435
				Adj R-squared =	0.5418
				Root MSE =	1.014959
Total	1796.1973	799	2.24805671	Res. dev. =	2290.049

lny	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/b1	44.61929	18.46923	2.42	0.016	8.365132	80.87344
/b4	.9727399	.0317777	30.61	0.000	.9103618	1.035118
/b3	-.8096595	.216987	-3.73	0.000	-1.235594	-.3837251
/b2	.2349665	.0326981	7.19	0.000	.1707818	.2991512

```
Parameter b4 taken as constant term in model & ANOVA table
```

The change of max. iteration and convergence value reflect in change of explaned sum square (ESS) which (ii) was more restrict, therefor have a higher ESS

(ii)

```
Iteration 30:  residual SS =  819.9925
Iteration 31:  residual SS =  819.9925
Iteration 32:  residual SS =  819.9925
```

Source	SS	df	MS		
Model	222930.73	4	55732.6813	Number of obs =	800
Residual	819.99246	796	1.03014129	R-squared =	0.9963
				Adj R-squared =	0.9963
				Root MSE =	1.014959
Total	223750.72	800	279.688397	Res. dev. =	2290.048

lny	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/b1	44.64759	18.90461	2.36	0.018	7.538809	81.75636
/b4	.9727292	.0317774	30.61	0.000	.9103518	1.035107
/b3	-.807984	.2186225	-3.70	0.000	-1.237129	-.3788392
/b2	.2351024	.0328463	7.16	0.000	.1706267	.2995781

g) Both model have significant overall test. But in term of individual test, model (1) have an insignificant in γ, so Model (2) be better to use.

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