

Assignment 4b: SUR-Demand

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This document walks through the results of my code. Please see the code in the `assignment4b.R` file attached to the Canvas submission, or look at the last few pages of this document for my code.

Method 1: An Ideal Demand System

```
summary(aids)
```

```
systemfit results  
method: SUR
```

	N	DF	SSR	detRCov	OLS-R2	McElroy-R2
system	143265	143214	60864.8	0.024439	0.075743	NA

	N	DF	SSR	MSE	RMSE	R2	Adj R2
eq1	47755	47738	13408.60	0.280879	0.529980	0.035918	0.035595
eq2	47755	47738	37811.73	0.792068	0.889982	0.093304	0.093000
eq3	47755	47738	9644.47	0.202029	0.449477	0.058323	0.058008

The covariance matrix of the residuals used for estimation

	eq1	eq2	eq3
eq1	0.2808789	-0.131619	-0.0311993
eq2	-0.1316193	0.792068	-0.2262513
eq3	-0.0311993	-0.226251	0.2020292

The covariance matrix of the residuals

	eq1	eq2	eq3
eq1	0.2808789	-0.131619	-0.0311993

```
eq2 -0.1316193  0.792068 -0.2262513
eq3 -0.0311993 -0.226251  0.2020292
```

The correlations of the residuals

```
          eq1          eq2          eq3
eq1  1.000000 -0.279048 -0.130972
eq2 -0.279048  1.000000 -0.565591
eq3 -0.130972 -0.565591  1.000000
```

SUR estimates for 'eq1' (equation 1)

Model Formula: $\log(\text{exp_share_Food}) \sim \log(\text{price_Food}) + \log(\text{size}) + \log(\text{rooms}) +$
 $\text{as.factor}(\text{year}) + \text{as.factor}(\text{province})$

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-2.79678e+00	2.44518e+00	-1.14379	0.2527156
log(price_Food)	7.69357e-07	5.25641e-01	0.00000	0.9999988
log(size)	8.67236e-02	5.14066e-03	16.87013	< 2.22e-16 ***
log(rooms)	-8.92835e-02	6.91881e-03	-12.90446	< 2.22e-16 ***
as.factor(year)2006	-1.88290e-08	1.49927e-02	0.00000	0.9999990
as.factor(year)2007	-4.05549e-08	2.87674e-02	0.00000	0.9999989
as.factor(year)2008	-6.80538e-08	4.71421e-02	0.00000	0.9999988
as.factor(year)2009	-1.07037e-07	7.35494e-02	0.00000	0.9999988
as.factor(province)11	-8.49007e-02	1.96546e-02	-4.31963	1.5661e-05 ***
as.factor(province)12	-1.09811e-01	2.21349e-02	-4.96101	7.0367e-07 ***
as.factor(province)13	-1.06814e-01	1.92831e-02	-5.53924	3.0538e-08 ***
as.factor(province)24	-4.96156e-02	1.73102e-02	-2.86626	0.0041553 **
as.factor(province)35	-2.73350e-01	1.22303e-02	-22.35016	< 2.22e-16 ***
as.factor(province)46	-2.03097e-01	1.41740e-02	-14.32890	< 2.22e-16 ***
as.factor(province)47	-2.63920e-01	1.16222e-02	-22.70827	< 2.22e-16 ***
as.factor(province)48	-2.33571e-01	1.12346e-02	-20.79037	< 2.22e-16 ***
as.factor(province)59	-1.71844e-01	1.23257e-02	-13.94193	< 2.22e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.52998 on 47738 degrees of freedom

Number of observations: 47755 Degrees of Freedom: 47738

SSR: 13408.595946 MSE: 0.280879 Root MSE: 0.52998

Multiple R-Squared: 0.035918 Adjusted R-Squared: 0.035595

SUR estimates for 'eq2' (equation 2)

Model Formula: $\log(\text{exp_share_Transportation}) \sim \log(\text{price_Transportation}) + \log(\text{size}) +$

log(rooms) + as.factor(year) + as.factor(province)

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-4.19044e+00	1.62292e+00	-2.58204	0.0098249	**
log(price_Transportation)	-2.27652e-07	3.43036e-01	0.00000	0.9999995	
log(size)	2.44609e-01	8.63257e-03	28.33556	< 2.22e-16	***
log(rooms)	4.79873e-01	1.16186e-02	41.30218	< 2.22e-16	***
as.factor(year)2006	6.24792e-09	1.60107e-02	0.00000	0.9999997	
as.factor(year)2007	9.07398e-09	1.88544e-02	0.00000	0.9999996	
as.factor(year)2008	1.28683e-08	2.33591e-02	0.00000	0.9999996	
as.factor(year)2009	-1.31823e-09	1.30165e-02	0.00000	0.9999999	
as.factor(province)11	-4.21502e-02	2.28127e-02	-1.84766	0.0646571	.
as.factor(province)12	-5.37256e-02	2.11036e-02	-2.54581	0.0109056	*
as.factor(province)13	1.45680e-01	2.09543e-02	6.95228	3.6402e-12	***
as.factor(province)24	-7.02435e-02	1.75967e-02	-3.99186	6.5654e-05	***
as.factor(province)35	-6.94058e-02	1.68495e-02	-4.11915	3.8092e-05	***
as.factor(province)46	3.68403e-02	1.97923e-02	1.86135	0.0627008	.
as.factor(province)47	6.94590e-02	2.13119e-02	3.25916	0.0011182	**
as.factor(province)48	-5.22632e-02	1.90462e-02	-2.74402	0.0060714	**
as.factor(province)59	-1.22981e-01	1.85139e-02	-6.64262	3.1146e-11	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.889982 on 47738 degrees of freedom

Number of observations: 47755 Degrees of Freedom: 47738

SSR: 37811.731446 MSE: 0.792068 Root MSE: 0.889982

Multiple R-Squared: 0.093304 Adjusted R-Squared: 0.093

SUR estimates for 'eq3' (equation 3)

Model Formula: log(exp_share_Shelter) ~ log(price_Shelter) + log(size) + log(rooms) +
as.factor(year) + as.factor(province)

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-2.41283e+00	2.84167e-01	-8.49087	< 2.22e-16	***
log(price_Shelter)	-1.69411e-08	6.01344e-02	0.00000	1	
log(size)	-1.07124e-01	4.35980e-03	-24.57089	< 2.22e-16	***
log(rooms)	-9.05359e-02	5.86785e-03	-15.42915	< 2.22e-16	***
as.factor(year)2006	6.10814e-10	6.83156e-03	0.00000	1	
as.factor(year)2007	1.27748e-09	7.88404e-03	0.00000	1	
as.factor(year)2008	2.19406e-09	1.00864e-02	0.00000	1	
as.factor(year)2009	2.15131e-09	9.97093e-03	0.00000	1	
as.factor(province)11	1.93038e-01	1.14189e-02	16.90515	< 2.22e-16	***

```

as.factor(province)12  1.64944e-01  9.58216e-03  17.21361 < 2.22e-16 ***
as.factor(province)13  7.41504e-02  9.74783e-03   7.60686 2.8644e-14 ***
as.factor(province)24  1.34912e-01  9.30467e-03  14.49943 < 2.22e-16 ***
as.factor(province)35  2.74755e-01  9.03750e-03  30.40167 < 2.22e-16 ***
as.factor(province)46  1.61902e-01  1.00861e-02  16.05199 < 2.22e-16 ***
as.factor(province)47  1.59917e-01  9.47641e-03  16.87524 < 2.22e-16 ***
as.factor(province)48  2.35158e-01  1.14434e-02  20.54959 < 2.22e-16 ***
as.factor(province)59  2.26328e-01  1.05617e-02  21.42903 < 2.22e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

Residual standard error: 0.449477 on 47738 degrees of freedom
Number of observations: 47755 Degrees of Freedom: 47738
SSR: 9644.470462 MSE: 0.202029 Root MSE: 0.449477
Multiple R-Squared: 0.058323 Adjusted R-Squared: 0.058008

```

I present the results of the AIDS estimation by seemingly unrelated regression below:

Method 2: Crawford Paper

I estimate the COLI approach from the 2022 Crawford paper. Note that this does not imply estimating any kind of regression, so I only present the average COL increase in % terms by province across all years. Please review my code if you need to know that I ran the actual model. I followed the given formula below:

$$1 + \pi = \frac{q' \cdot p'}{q \cdot p}$$

where variables with a prime are the ones estimated after the tax increase.

```

kable(average_col_province,
      format = 'latex',
      booktabs = TRUE,
      longtable = T)

```

province	MeanCol
Newfoundland and Labrador	28.52081
Prince Edward Island	30.03678
Nova Scotia	28.26923
New Brunswick	26.46034

Quebec	26.79842
Ontario	26.18246
Manitoba	26.31703
Saskatchewan	29.81776
Alberta	37.44424
British Columbia	22.88087
