

GST Reform in Australia: Implications of Estimating Price Elasticities of Demand for Food

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46th Australian Conference of Economists (ACE 2017)

July 21, 2017

GST Reform?

- The Australian Goods and Services Tax (GST)
 - A 10% value added tax on most goods and services
- GST revenue passed on to State and Territory governments
 - Around \$59 billion in 2015-16
- The (ongoing?) policy debate in Australia
 - Focuses on increasing rate to 15% and/or broadening base

Phillips and Taylor (2015)

- Increasing the rate to 15% without expanding the base
 - Increase revenue by \$29.4 billion
- Expanding the base to cover currently exempted food
 - Increase revenue by \$7.1 billion
- Expanding the base to health, education, water & sewerage
 - Increase revenue by \$11.5 billion

GST Reform? (contd.)

- Great potential of a GST reform to mitigate fiscal pressures
- Uncertain about consumer responses of a food GST reform
- Particularly implications for low-income households
- Regressivity of & negative public attitudes towards GST change
 - Governments reluctant to make changes to the GST

Past Studies

- Powell et al. (2013)
 - Taxes (subsidies) on fast food (fruits and veg.) lower obesity
- Andreyeva et al. (2010)
 - Potential benefits resulting from a tax on soft drinks
- Wirsenius et al. (2011)
 - Meat consumption tax may significantly reduce GHG emissions
- Reisch et al. (2013)
 - Reducing meat contributes in sustainable food consumption

What We Did

- Study the potential impact of changes in the GST on food
- Estimate price elasticity of demand by category (Homescan)
- Indicate costs and benefits of GST reform options (HILDA)
 - (A) broadening the tax base to include selected food categories
 - (B) broadening the base to include all food categories
 - (C) increasing GST rate to 15% (without broadening tax base)
 - (D) (C) + broadening the base to include selected food categories
 - (E) (C) + broadening the base to include all food categories
- Compared benefits (Revenue gains) vs. costs (welfare loss)
 - Focuses bottom 40% household in income distribution

Data: Nielsen Homescan Survey

- Weekly data from 02/12/2012 to 28/11/2015
- We focus on quarter, year, barcode, price, quantity and income
- Households in the analysis sample (balanced panel): 8,394
- Observations in the analysis sample: 19,542,317

Empirical Strategy: AIDS Model

$$w_{iht} = \alpha + \beta \ln(p_{iht}) + \sum_{j \in \mathcal{J}} \gamma_j \ln(\bar{p}_{jt}) + \delta \ln(X_{ht}) + \rho \ln(Z_{ht}) \\ + \phi_j + \lambda_t + u_{iht},$$

where, for each item i , household h and time t ,

- w_{iht} : expenditure share
- p_{iht} : price
- \bar{p}_{jt} : state-level aggregate price of food categories $k \neq j$
- X_{ht} : total household expenditure on food
- Z_{ht} : household size
- ϕ_j : barcode fixed effects
- λ_t : time fixed effects

Empirical Strategy: AIDS Model (contd.)

- Barcode FE netted out the original distribution of prices
- The conditional expectation $E[u_{iht} | \ln(X_{ht})] = 0$
 - ⇒ The price elasticity of demand, $\eta_{ij} = \frac{\partial q_i}{\partial p_i} \frac{p_i}{q_i} = -1 + \frac{\beta_{ij}}{w_{iht}}$
- **Problem:** The estimates may be biased
 - As expenditure shares and total expenditure are jointly determined
 - Used household income as an instrument of food expenditure
 - Income have no direct impact on expenditure shares (valid)
 - Income is highly correlated with total food expenditure (strong)
- We estimate our model separately for 33 food categories
- Also employed QUAIDS model for robustness check

Estimates of price elasticities by food categories

	AIDS Model		QUAIDS Model	
	OLS	IV	OLS	IV
<i>All categories</i>	-0.390*** (0.011)	-0.416*** (0.020)	-0.425*** (0.011)	-0.429*** (0.018)
<i>GST-free categories</i>	-0.411*** (0.012)	-0.439*** (0.022)	-0.445*** (0.012)	-0.452*** (0.023)
<i>GST categories</i>	-0.214*** (0.018)	-0.230*** (0.022)	-0.247*** (0.015)	-0.242*** (0.019)

Note: Robust standard errors were clustered at the household level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The impact of alternative GST reform scenarios on food consumption

	Low-income households	All
Mean food consumption (\$)	4,903	6,964
GST categories (\$)	1,227	1,851
GST free categories (\$)	3,676	5,112
Selected GST free categories (\$)†	1,353	1,874
Mean change in food consumption (\$)		
A. Broaden base selectively	-38.15	-52.85
B. Broaden base	-161.38	-224.42
C. Increase rate on GST categories to 15%	-13.00	-19.25
D. Increase rate & broaden base selectively	-70.23	-98.52
E. Increase rate & broaden base	-254.88	-355.62
Mean household income (\$1,000)	30.59	87.77

Note: Low-income households refer to the bottom 40% of the income distribution.

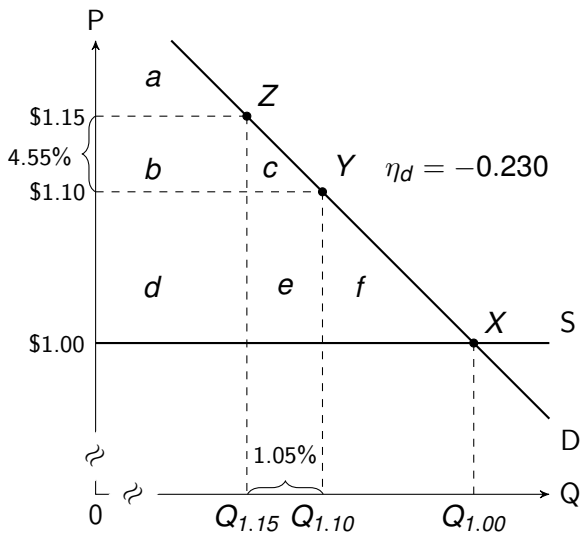
† Selected categories include: (i) Meat and poultry, (ii) canned and frozen fruit and nuts, (iii) canned spaghetti and baked beans, (iv) sauces and salad dressings, (v) spreads and dips, (vi) butter, oil and cream, (vii) packaged waters, (viii) canned and bottled fish and seafood, and (ix) sugar, marmalade, jams and syrups.

The impact of alternative GST reform scenarios on food consumption

	Low-income households	All
<u>Change in food consumption, % of income</u>		
A. Broaden base selectively	-0.12	-0.09
B. Broaden base	-0.53	-0.26
C. Increase rate on GST categories to 15%	-0.04	-0.02
D. Increase rate & broaden base selectively	-0.23	-0.11
E. Increase rate & broaden base	-0.83	-0.41

Note: Low-income households refer to the bottom 40% of the income distribution.

† Selected categories include: (i) Meat and poultry, (ii) canned and frozen fruit and nuts, (iii) canned spaghetti and baked beans, (iv) sauces and salad dressings, (v) spreads and dips, (vi) butter, oil and cream, (vii) packaged waters, (viii) canned and bottled fish and seafood, and (ix) sugar, marmalade, jams and syrups.



Impact of raising GST rate from 10% to 15%
when the supply curve is perfectly elastic

Current revenue from GST on food

- Current revenue = $0.10 \times \frac{\text{food expenditure on GST items}}{(1.00+0.10)}$
 - Mean household consumption of GST items (incl. GST) = \$1,851
 - Number of Australian households = 8,902,436
- Current GST revenue ($d + e$):

$$0.10 \times 8,902,436 \times \frac{\$1,851}{1.10} = \$1.5 \text{ billion}$$

A. Broaden base to selected categories

(assuming a perfectly elastic supply curve)

- Price elasticity of demand for selected food items: -0.282
 - Increasing GST from 0% to 10%:
 - Price increase of 10%
 - Quantity consumed is reduced by $0.282 \times 10\% \approx 2.82\%$
 - Mean household consumption of selected items (incl. GST) = \$1,874
 - Number of Australian households = 8,902,436
- Additional GST revenue:

$$0.10 \times 8,902,436 \times \$1,874 \times (1 - 0.0282) = \$1.6 \text{ billion}$$

B. Broaden base to all categories

- Price elasticity of demand for non-GST food items: -0.439
 - Increasing GST from 0% to 10%:
 - Price increase of 10%
 - Quantity consumed is reduced by $0.439 \times 10\% \approx 4.39\%$
 - Mean household consumption of Non-GST food items = \$5,112
 - Number of Australian households = 8,902,436
- Additional GST revenue:

$$0.10 \times 8,902,436 \times \$5,112 \times (1 - 0.0439) = \$4.4 \text{ billion}$$

C. Increase rate on GST categories to 15%

- Price elasticity of demand for food items that attract GST: -0.230
- Increasing GST from 10% to 15%:
 - A price increase of $(1.15-1.10)/1.10 \approx 4.55\%$
 - Quantity consumed is reduced by $-0.230 \times 0.455 \approx 1.05\%$
- Mean household consumption of GST items (incl. GST) = \$1,851
- Number of Australian households = 8,902,436

→ Total GST revenue ($b + d$):

$$0.15 \times 8,902,436 \times \frac{\$1,851}{1.10} \times (1 - 0.01047) = \$2.2 \text{ billion}$$

Additional revenue:

$$\$2.2 \text{ billion} - \$1.5 \text{ billion} = \$0.7 \text{ billion}$$

D. Increase rate and broaden base to selected categories

- Price elasticity of demand for selected food items: -0.282
 - Increasing GST from 0% to 15%:
 - Price increase of 15%
 - Quantity consumed is reduced by $0.282 \times 15\% \approx 4.23\%$
 - Mean household consumption of selected items (incl. GST) = \$1,874
 - Number of Australian households = 8,902,436
- Total GST revenue (Reform C + imposing a GST rate of 15% to selected categories):

$$\text{\$2.2 billion} + 0.15 \times 8,902,436 \times \text{\$1,874} \times (1 - 0.0423) = \text{\$4.6 billion}$$

Additional revenue:

$$\text{\$4.6 billion} - \text{\$1.5 billion} = \text{\$3.1 billion}$$

E. Increase rate and broaden base to all categories

- Price elasticity of demand for non-GST food items: -0.439
 - Increasing GST from 0% to 15%:
 - Price increase of 15%
 - Quantity consumed is reduced by $0.439 \times 15\% \approx 6.59\%$
 - Mean household consumption of non-GST items = \$5,112
 - Number of Australian households = 8,902,436
- Total GST revenue (Reform C+ imposing a GST rate of 15% to items that do not attract GST):
- $$\$2.2 \text{ billion} + 0.15 \times 8,902,436 \times \$5,112 \times (1 - 0.0659) = \$8.6 \text{ billion}$$

Additional revenue:

$$\$8.6 \text{ billion} - \$1.5 \text{ billion} = \$7.1 \text{ billion}$$

Estimate of additional GST revenues resulting from
alternative reform scenarios (in \$ million)

A. Broaden base to selected categories	1,621
B. Broaden base to all categories	4,351
C. Increase rate on GST categories to 15%	726
D. Increase rate and broaden base to selected categories	3,122
E. Increase rate and broaden base to all categories	7,102

Method of Estimating Compensation

- Price rises with a higher GST rate or broadening the base
- Used Compensating variation (CV) measure of welfare change
- CV describes the required compensation to keep a consumer as well off compared to his/her welfare before the price change
- Using the superscript 0 (1) to indicate the observed value of a variable before (after) the price change

$$CV = \Delta E_h = E_h(P^1, u_h^0) - E_h(P^0, u_h^0),$$

- where, P is a price vector of individual prices p_i ($i = 1, 2 \dots, n$), and
- E_h is the minimum expenditure (including savings) required for household h to reach an utility level u^0

Method of Estimating Compensation (contd.)

- With a first-order approximation for discrete price changes,

$$CV \approx \sum_{i=1}^N p_i q_{ih} \frac{\Delta p_i}{p_i},$$

- where, q_{ih} is the quantity of item i consumed by household h
- Estimated the last expression for each household

Compensation payments to low-income households

Per household (\$)

A. Broaden base to selected categories	135
B. Broaden base to all categories	368
C. Increase rate on GST categories to 15%	56
D. Increase rate and broaden base to selected categories	259
E. Increase rate and broaden base to all categories	607

Fiscal cost (\$ million)

A. Broaden base to selected categories	481
B. Broaden base to all categories	1,310
C. Increase rate on GST categories to 15%	199
D. Increase rate and broaden base to selected categories	922
E. Increase rate and broaden base to all categories	2,162

Conclusions

- Increasing the GST on food from 10% to 15%:
 - Additional revenue: \$726 million
 - Required compensation of low-income households: \$199 million
- Increasing rate and broadening the base to selected food categories:
 - Additional revenue: \$3.1 billion
 - Required compensation of low-income households: \$922 million
- Scope for raising revenue by broadening the GST base and rate
 - Even if the bottom 40% of the households were compensated
- A food GST reform with compensating low-income households
 - Would reduce fiscal pressures considerably
 - Would address issue of regressivity of GST

Contributions

- Estimated price elasticity of demand by food categories
- Indicated costs and benefits of a number of GST reform options
- For a flexible choice of reform items
 - Indicated item wise costs and benefits of reform

The impact of broadening the base (without increasing the rate):
 GST Revenues and Compensation payments (\$ million) by category

	Elasticity	Revenue	Compensation
Bread	0.000	325	96
Flour	-0.243	16	4
Cereals, pasta and rice	-0.309	211	60
Meat and poultry	-0.462	1,103	328
Fish and seafood	-0.715	150	45
Canned and bottled fish and seafood	0.000	66	19
Fresh eggs	0.000	65	20
Fresh milk	0.000	306	96
Cheese	0.000	203	52
Butter, oil and cream	-0.176	113	39
Yogurt	0.000	111	30
Dairy products	-0.401	73	22
Fresh fruit	-0.441	493	145

Note: Estimated elasticities that are not statistically significant are assumed to be zero. Compensation payments are for households in the bottom 40% of the household income distribution.

The impact of broadening the base (without increasing the rate) – continued

	Elasticity	Revenue	Compensation
Canned and frozen fruit and nuts	-0.276	62	22
Fresh vegetables	-0.490	550	163
Frozen vegetables	-0.210	58	20
Sugar, marmalade, jams and syrups	0.000	51	18
Honey	0.000	15	5
Spreads and dips	0.000	59	16
Canned spaghetti and baked beans	-0.276	16	5
Packaged waters	0.000	56	11
Tea	-0.368	36	12
Coffee	-0.299	80	28
Vegetable juice and packed soup	0.000	40	13
Canned and bottled baby foods	-0.613	11	2
Sauces and salad dressings	-0.216	84	23
Total	-0.439	4,351	1,309

Note: Estimated elasticities that are not statistically significant are assumed to be zero. Compensation payments are for households in the bottom 40% of the household income distribution.

The impact of broadening the base and increasing the rate to 15%:
 GST Revenues and Compensation payments (\$ million) by category

	Elasticity	Revenue	Compensation
GST-free categories			
Bread	0.000	488	145
Flour	-0.243	23	7
Cereals, pasta and rice	-0.309	311	90
Meat and poultry	-0.462	1,615	492
Fish and seafood	-0.715	217	68
Canned and bottled fish and seafood	0.000	98	29
Fresh eggs	0.000	98	30
Fresh milk	0.000	460	144
Cheese	0.000	304	79
Butter, oil and cream	-0.176	167	59
Yogurt	0.000	166	44
Dairy products	-0.401	107	33
Fresh fruit	-0.441	723	217

Note: Estimated elasticities that are not statistically significant are assumed to be zero. Compensation payments are for households in the bottom 40% of the household income distribution.

The impact of broadening the base and increasing the rate to 15% – continued

	Elasticity	Revenue	Compensation
GST-free categories			
Canned and frozen fruit and nuts	-0.276	91	32
Fresh vegetables	-0.490	804	245
Frozen vegetables	-0.210	86	30
Sugar, marmalade, jams and syrups	0.000	76	27
Honey	0.000	22	7
Spreads and dips	0.000	88	24
Canned spaghetti and baked beans	-0.276	24	8
Packaged waters	0.000	85	16
Tea	-0.368	52	18
Coffee	-0.299	118	42
Vegetable juice and packed soup	0.000	60	20
Canned and bottled baby foods	-0.613	16	3
Sauces and salad dressings	-0.216	124	34
Total	-0.439	6,377	1,964

Note: Estimated elasticities that are not statistically significant are assumed to be zero. Compensation payments are for households in the bottom 40% of the household income distribution.

The impact of broadening the base and increasing the rate to 15% – continued

	Elasticity	Revenue	Compensation
GST categories			
Cake, biscuit, pudding and bread mixes	-0.220	173	52
Spices and other food additives	-0.119	34	9
Confectionery (including ice cream)	-0.163	243	65
Frozen prepared meals	-0.259	86	26
Soft drinks	-0.381	126	31
Mixed fruit juice	-0.274	53	13
Cordials	-0.248	10	3
Total	-0.230	726	199

Note: Estimated elasticities that are not statistically significant are assumed to be zero. Compensation payments are for households in the bottom 40% of the household income distribution.