

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

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GST reform?

- The Australian Goods and Services Tax (GST) is a 10% value added tax on most goods and services
- The GST revenue is passed on to State and Territory governments, around \$59 billion in 2015-16
- The (ongoing?) policy debate in Australia focuses on an increase in the rate to 15% and/or broadening the base
- Phillips and Taylor (2015):
 - Increasing the rate to 15% without expanding the base would increase revenue by \$29.4 billion
 - Expanding the base to cover currently exempted food would increase revenue by \$7.1 billion
 - Expanding the base to cover other items (health, education, water and sewerage): \$11.5 billion

Contribution of this paper

- We use detailed information about supermarket purchases to estimate the price elasticity of demand for a range of food categories
- An IV strategy is employed to address endogeneity issues
- We study the implications of
 - (i) a hypothetical increase in the Goods and Services Tax (GST) from 10% to 15%
 - (ii) broadening the base to selected food categories

Data: Nielsen Homescan Survey (daily data from 02.12.2012 to 28.11.2015)

Selected variables

- **Product related information:** Barcode (including description), brand, size, category of product, date of purchase, shop description, quantity and price, if the product is on sale, household weight
- **Demographic variables:** household size, ID of shopper and household head, city, gender, date of birth, occupation group, education group, full-time/part-time employed, country of birth, relation to head, marital status, height and weight

Data

- Total number of households: 10,794
- Total number of households in the analysis sample (balanced panel): 8,394
- Total number of transactions: 24,645,163
 - We drop observations with missing information on postcode and non-food items: 38,392
 - We drop heterogeneous observations that do not belong to any of the categories we defined: 1,910,182
 - We drop observations with missing information on size, price, quantity, unit, household size and instrument: 1,866,845
- Total number of observations in the analysis sample: 20,829,744
- We also use data from HILDA and HES to perform robustness checks

Empirical strategy: AIDS Model

$$w_{iht} = \alpha_i + \beta_{ii} \ln(p_{iht}) + \sum_{j \neq i} \beta_{ij} \ln(p_{jht}) + \gamma_i \ln(X_{ht}) + \delta_i \ln(Z_{ht}) + \phi_i + \lambda_t + u_{iht}$$

- w_{iht} : expenditure share of item i of household h at time t
- p_{iht} : price of item i
- X_{ht} : total household expenditure on food
- Z_{ht} : household size
- ϕ_i : barcode fixed effects
- λ_t : time fixed effects

→ $\eta_{ii} = \frac{\partial q_i}{\partial p_i} \frac{p_i}{q_i} = \frac{\beta_{ii}}{w_{iht}} - 1$ gives us the price elasticity of demand if the conditional expectation $E[u_{iht} | \ln(p_{iht})]$ is equal to zero

Instrument

- To construct the instrument for the price of a product at a specific period in a state s , for each barcode, year and quarter, we take the weighted average of prices in all other states:

$$IV_{sit} = \sum_{m \neq s} price_{mit}$$

- We also employ household income as an instrument of total household expenditure on food items

Table 2: Estimates of price elasticities by food categories

	AIDS Model		QUAIDS Model	
	OLS	IV	OLS	IV
<i>All food items</i>	-0.422*** (0.009)	-0.193*** (0.023)	-0.460*** (0.007)	-0.203*** (0.013)
<i>GST free items</i>	-0.452*** (0.008)	-0.133*** (0.037)	-0.489*** (0.007)	-0.142*** (0.019)
<i>GST items</i>	-0.170*** (0.014)	-0.534*** (0.032)	-0.200*** (0.012)	-0.552*** (0.057)

Note: Standard errors in parentheses.

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

Table 3: Ranking of items by elasticity – Non-GST items

Ranking	OLS	IV	
$\eta_d < -0.30$ ("more elastic")	1	Canned and bottled baby foods	Tea
	2	Fresh vegetables	Flour
	3	Tea	Meat and poultry
	4	Meat and poultry	Fresh milk
	5	Fresh fruit	Canned and bottled baby foods
	6	Dairy products nec	Honey
	7	Cheese	Fish and seafood
	8	–	Canned and bottled fish and seafood
	9	–	Yogurt
	10	–	Canned spaghetti and baked beans
	11	–	Fresh fruit
	12	–	Frozen vegetables
	13	–	Sugar, marmalade, jams and syrups

Table 3 (contd.): Ranking of items by elasticity – Non-GST items

	Ranking	OLS	IV
$\eta_d > -0.30$ ("less elastic")	8	Canned and frozen fruit and nuts	–
	9	Fish and seafood	–
	10	Cereals, pasta and rice	–
	11	Coffee	–
	12	Canned spaghetti and baked beans	–
	13	Yogurt	–
	14	Flour	Cheese
	15	Frozen vegetables	Coffee
	16	Sauces and salad dressings	Butter, oil and cream
	17	Spreads and dips	Cereals, pasta and rice
	18	Butter, oil and cream	Canned and frozen fruit and nuts
	19	Packaged waters	Bread
	20	Fresh eggs	Sauces and salad dressings
	21	Canned and bottled fish and seafood	Fresh vegetables
	22	Sugar, marmalade, jams and syrups	Spreads and dips
	23	Bread	Fresh eggs
	24	Honey	Vegetable juice and packed soup
	25	Vegetable juice and packed soup	Packaged waters
	26	Fresh milk	Dairy products nec

Table 4: The Impact of a GST increase on food consumption (weighted)
Analysis based on Homescan data

	Household income quintile					All
	1	2	3	4	5	
Mean change in food con. (\$) ^a	-198	-229	-243	-259	-271	-240
GST items (\$) ^b	-49	-55	-59	-60	-59	-56
GST free items (\$) ^c	-149	-174	-184	-199	-213	-184
Proposed policy reform (\$) ^c	-36	-41	-42	-43	-44	-41
Mean change as % of income ^a	-0.86	-0.49	-0.33	-0.26	-0.18	-0.31
GST items ^b	-0.21	-0.12	-0.08	-0.06	-0.04	-0.07
GST free items ^c	-0.65	-0.38	-0.25	-0.20	-0.14	-0.23
Proposed policy reform ^c	-0.16	-0.09	-0.06	-0.04	-0.03	-0.05

^a Broadening the base and increasing the rate; ^b Increasing the rate from 10 to 15%;

^c Increasing the rate from 0 to 15%.

Table 5: Mean household income (weighted)
by income quintile, survey and year

Quintile	HES, 2009-10	HILDA, 2010	HILDA, 2014	Homescan, 2014
1	20,611	20,093	24,279	23,094
2	39,365	48,104	53,619	46,192
3	68,585	79,219	87,607	72,104
4	105,436	115,650	128,999	99,886
5	202,175	213,383	247,316	151,625
All	67,999	90,336	102,724	74,704

Table 6: The Impact of a GST increase on food consumption (weighted)
 Analysis based on HILDA 2014 data

	Household income quintile					All
	1	2	3	4	5	
Mean change in food con. (\$) ^a	-108	-141	-168	-186	-228	-167
GST items (\$) ^b	-33	-42	-50	-55	-63	-48
GST free items (\$) ^c	-76	-100	-118	-132	-165	-118
Mean change as % of income	-0.43	-0.26	-0.19	-0.14	-0.09	-0.15
GST items	-0.13	-0.08	-0.06	-0.04	-0.03	-0.04
GST free items	-0.30	-0.19	-0.13	-0.10	-0.07	-0.11

^a Broadening the base and increasing the rate; ^b Increasing the rate from 10 to 15%;

^c Increasing the rate from 0 to 15%.

Table 7: The Impact of a GST increase on food consumption (weighted)
 Analysis based on HES 2009-10 data

	Household income quintile					All
	1	2	3	4	5	
Mean change in food con. (\$) ^a	-112	-166	-221	-280	-376	-231
GST items (\$) ^b	-45	-74	-110	-149	-212	-118
GST free items (\$) ^c	-67	-92	-111	-131	-164	-113
Mean change as % of income	-0.57	-0.41	-0.32	-0.27	-0.18	-0.26
GST items	-0.23	-0.18	-0.16	-0.14	-0.10	-0.13
GST free items	-0.34	-0.23	-0.16	-0.12	-0.08	-0.13

^a Broadening the base and increasing the rate; ^b Increasing the rate from 10 to 15%;

^c Increasing the rate from 0 to 15%.

Table 8: Required compensation
Analysis based on Homescan data

	Household income quintile					All
	1	2	3	4	5	
All (bil. \$) ^a	2.24	2.62	2.76	2.97	3.16	13.75
GST items (bil. \$) ^b	0.17	0.19	0.21	0.21	0.21	0.98
GST free items (bil. \$) ^c	2.07	2.42	2.56	2.76	2.95	12.77
Proposed policy reform (bil. \$) ^c	0.28	0.31	0.32	0.33	0.33	1.56

^a Broadening the base and increasing the rate; ^b Increasing the rate from 10 to 15%;

^c Increasing the rate from 0 to 15%.

Our estimates represent the compensating variation (CV) - a monetary measure of the welfare change due to a price change. Specifically, the CV describes the amount of the required compensation that is needed to keep a consumer as well off as before the price change.

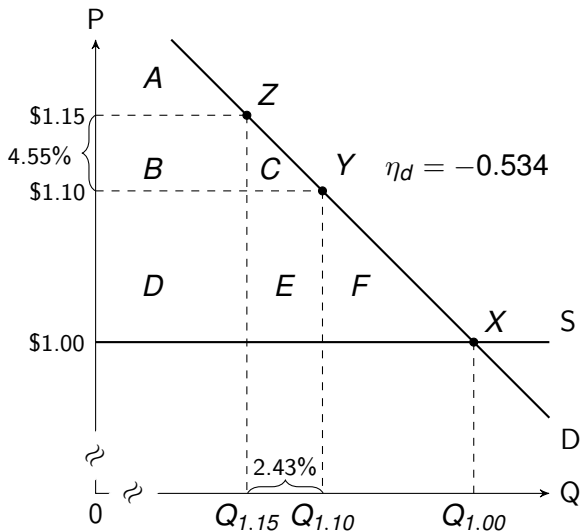


Figure 1: The impact of increasing the rate from 10% to 15%

GST increase from 10% to 15%

(assuming a perfectly elastic supply curve)

- Price elasticity of demand for food items that attract GST: -0.534
 - Increasing GST from 10% to 15%:
 - A price increase of $(1.15-1.10)/1.10 \approx 4.55\%$
 - Quantity consumed reduces by $0.534 \times 4.55\% \approx 2.43\%$
 - Mean household consumption of items that attract GST (incl. GST) = \$2,344
 - Number of Australian households = 9,241,500
- GST revenue ($B + D$):

$$9,241,500 \times 0.15 \times (1 - 0.0243) \times \frac{\$2,344}{1.10} = \$2.88 \text{ billion}$$

Current revenue from GST on food

$$\text{Current revenue} = \text{household food expenditure} \times \frac{0.10}{(1.00+0.10)}$$

- Mean household consumption of items that attract GST (incl. GST) = \$2,344
- Number of Australian households = 9,241,500

→ current GST revenue ($D + E$):

$$9,241,500 \times 0.10 \times \frac{\$2,344}{1.10} = \$1.97 \text{ billion}$$

Additional revenue from GST on food resulting from increasing the rate from 10% to 15%:

$$\$2.88 \text{ billion} - \$1.97 \text{ billion} = \$0.91 \text{ billion}$$

Broadening the base

- Price elasticity of demand for food items that do not attract GST: -0.133
 - Increasing GST from 0% to 15%:
 - Price increase of 15%
 - Quantity consumed reduces by $0.133 \times 15\% \approx 2.00\%$
 - Mean household consumption of items that attract GST (incl. GST) = \$9,211
 - Number of Australian households = 9,241,500
- GST revenue:

$$9,241,500 \times 0.15 \times (1 - 0.0200) \times \$9,211 = \$12.51 \text{ billion}$$

Broadening the base: Selected items

- Price elasticity of demand for selected food items: -0.243
 - Increasing GST from 0% to 15%:
 - Price increase of 15%
 - Quantity consumed reduces by $0.243 \times 15\% \approx 3.65\%$
 - Mean household consumption of selected items (incl. GST) = \$1,128
 - Number of Australian households = 9,241,500
- GST revenue:

$$9,241,500 \times 0.15 \times (1 - 0.0365) \times \$1,128 = \$1.51 \text{ billion}$$

Robustness check: Results based on HILDA

- **GST increase from 10% to 15%**
 - GST revenue ($B + D$): \$2.48 billion
 - current GST revenue ($D + E$): \$1.69 billion
 - additional revenue: \$0.79 billion
- **Broadening the base**
 - GST revenue: \$10.53 billion

Robustness check: Results based on HES

- **GST increase from 10% to 15%**
 - GST revenue ($B + D$): \$6.05 billion
 - current GST revenue ($D + E$): \$4.13 billion
 - additional revenue: \$1.92 billion
- **Broadening the base**
 - GST revenue: \$7.74 billion

Conclusions

- Increasing the GST on food from 10% to 15%:
 - Additional revenue: \$0.91 billion
 - Required compensation of low-income households (bottom 40%): \$360 million
 - Broadening the base to selected food categories:
 - Additional revenue: \$1.51 billion
 - Required compensation of low-income households (bottom 40%): \$590 million
- There is considerable scope for broadening the GST base to include selected food categories