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MORE ON THE PRICE-RESPONSIVENESS OF FOOD CONSUMPTION

by

Kenneth W Clements
Business School
University of Western Australia

and

Jiawei Si
Business School
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DISCUSSION PAPER 15.03

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ABSTRACT

Cornelsen et al. (2014) and Green et al. (2013) provide a comprehensive review/summary of a large number of recent estimates of the price responsiveness of food consumption using a meta-regression approach. For seven food items, they present uncompensated elasticities that include both the income and substitution effects of price changes. As for some policy purposes, the substitution effects need to be isolated, in this note we introduce a way of recovering these in the form of the compensated elasticities from their uncompensated counterparts.

[*] We thank Rosemary Green and Laura Cornelsen for sending us the data underlying Cornelsen et al. (2014) and for responding to our enquiries. We also thank the World Bank for sending us unpublished data. This research was supported in part by the ARC and BHP Billiton.

1. Introduction

Suppose the government wishes to reduce the consumption of some type of food by taxing it. When consumers' money income remains unchanged, for consumption to be reduced by 25 percent, the tax has to be such as to increase the price of the good by $-25/\eta_{ii}$ percent, where $\eta_{ii} < 0$ is the own-price elasticity of demand for the good, denoted by the subscript i. Thus, if, for example, $\eta_{ii} = -1/2$, the price has to rise by $-25/(-1/2) = 50$ percent. This 50-percent price increase will change consumption of a related food j, in percentage terms, by $\eta_{ji} \times 50$, where η_{ji} is the cross-price elasticity of demand. If goods j and i are substitutes, $\eta_{ji} > 0$, so the tax on i leads to a rise in the consumption of j. As money income is taken to be constant, these elasticities contain both income and substitution effects of the price change and are known as uncompensated elasticities.

In two recent papers, Cornelsen et al. (2014) and Green et al. (2013) summarise 78 studies of food demand carried out since 1990 using a meta-regression approach. These two papers represent a major contribution in synthesising such a large body of research. Table 1 gives the estimated price elasticities from Cornelsen et al. (2014) for seven foods in three groups of countries, distinguished by income per capita.[1]

The uncompensated elasticity is the appropriate concept to use in many circumstances, but not all. For example, when the government imposes an additional tax on the food item, the price paid by consumers rises and with money income held constant, their real income consequently falls. But that may not be the end of the story. The government now has additional revenue which they could use to lower other taxes in order to keep the overall budgetary position unchanged. In such a case, consumers' after-tax money income rises, bringing their real income back to the old value, that is, the pre-food-tax value. In all likelihood, some of this additional income would be spent on the good that is taxed. How much is spent on the good depends on its income elasticity. This second-round effect on consumption is the income effect of the initial tax increase. Stripping out the income effect from the uncompensated elasticity leaves the compensated price elasticity. As the compensated elasticity takes account of the tax revenue, it gives the full impact of the food tax hike. In other words, the compensated elasticity excludes the income effect, and, thus,

[1] Cornelsen et al. (2014) draw upon the estimated own-price elasticities from Green et al. (2013), which is based on 136 studies over the same time period.

holds constant consumers' real income, whereas its uncompensated counterpart includes the income effect and has money income unchanged.

While cutting other taxes might be politically popular, this would not happen if the government increased its spending. If the additional spending is valued by consumers (as would be in the case of higher pension payments, for example), then disposable income rises by the amount of the tax proceeds. This has the effect of annihilating the income effect of the tax hike, and the net result on consumption of the good in question is the same as before when other taxes are reduced. That is, the overall impact of the tax increase is again given by the compensated elasticity.

When the additional revenue is used to reduce government borrowing, future debt service costs will be reduced. Thus, future taxes can be lowered or the government can spend more on other items. Under certain conditions, this is equivalent, in present value terms, to a cut in current taxes and/or an increase in current government spending. This is known as the Ricardian equivalence (Barro, 1989). When the government spending is wasteful and not valued by consumers, the tax proceeds are in effect lost and the uncompensated price elasticity is the relevant concept to use.

In summary, both the uncompensated and compensated elasticities contain information that is of considerable value to policy makers in understanding the response of consumers to price changes that result from tax changes (or any other source). In this note, we show how compensated elasticities can be recovered from the uncompensated elasticities reported by Cornelsen et al. (2014). When one approach is used, these compensated elasticities take account of non-food demands and satisfy the constraints of microeconomic theory, which would seem to be consistent with the suggestion of Cornelsen et al. (2014, p. 11) that "future studies should also consider…using full demand systems that also consider non-food expenditures."

2. Consumption Theory

Before turning to food specifically, it is useful to set out the microeconomic theory of the consumer in summary form.[2] Let there be n goods purchased by the consumer with prices $p_1,...,p_n$ and quantities $q_1,...,q_n$. Total expenditure is $M = \Sigma_{i=1}^{n} p_i q_i$ ("income" for short). The

[2] For further details of this material, see, for example, Clements (1987).

Marshallian demand for good i is $q_i = q_i(M, p_1, ..., p_n)$. Write this in differential form as $dq_i = (\partial q_i/\partial M)\,dM + \Sigma_{j=1}^{n}(\partial q_i/\partial p_j)\,dp_j$ or, using $d(\log x) = dx/x,\ x > 0,$

$$(1) \qquad d(\log q_i) = \eta_i(\log M) + \sum_{j=1}^{n} \eta_{ij} d(\log p_j),$$

where $\eta_i = (\partial q_i/\partial M)\cdot(M/q_i) = \partial(\log q_i)/\partial(\log M)$ is the income elasticity of demand for good i and $\eta_{ij} = (\partial q_i/\partial p_j)\cdot(p_j/q_i) = \partial(\log q_i)/\partial(\log p_j)$ is the $(i, j)^{th}$ uncompensated price elasticity. The income elasticity η_i gives the percentage change in consumption of good i following a one-percent rise in income. According to Engel's law, the proportion of income devoted to all types of food declines as income rises, which implies that its income elasticity is less than unity. The value of the price elasticity η_{ij} is the percentage change in consumption of good i resulting from a one-percent rise in the price of good j. For $i = j,$ we have the own-price elasticity η_{ii}, while for $i \neq j,$ η_{ij} is the cross-price elasticity. This η_{ij} is the uncompensated elasticity as it contains the income effect of the price change – that is, as money income is held constant in equation (1), real income falls as p_j rises and the impact of this income fall on q_i is the income effect.

If there is an equiproportional change in income and the n prices, consumption theory says that nothing should happen to any quantity consumed. Thus, if $d(\log M) = d(\log p_i) = k$ (some constant), $i = 1, ..., n,$ then, from equation (1), $d(\log q_i) = (\eta_i + \Sigma_{j=1}^{n}\eta_{ij})k,\ i = 1, ..., n.$ For consumption to be unchanged, we need

$$(2) \qquad \eta_i + \sum_{j=1}^{n} \eta_{ij} = 0, \quad i = 1, ..., n,$$

which is known as demand homogeneity (or the absence of money illusion).

The Slutsky equation decomposes the uncompensated elasticity into income and substitution effects:

$$(3) \qquad \eta_{ij} = \eta_{ij}^{*} - w_j \eta_i.$$

Here, η_{ij}^{*} is the $(i, j)^{th}$ compensated price elasticity (the substitution effect) and $w_j = p_j q_j/M$ is the proportion of income devoted to good j, which is known was the budget share. The income effect of a change in the price of good j is $-w_j\eta_i$; the magnitude of this effect depends on the relative importance of the good whose price changes, as measured by its

budget share, and the income elasticity of the good whose quantity changes, η_i. For the own-price effect, $(i = j)$, the income effect is $-w_i\eta_i = -\partial(p_i q_i)/\partial M$, which is the marginal propensity to consume (MPC) of the good, that is, how much of an additional one dollar of income is spent on this good. When the MPC is positive, as it will be in the vast majority of cases, the uncompensated own-price elasticity is larger in absolute value than its compensated counterpart. That is, the lower real income brought about by the price rise leads to lower spending on the good, which reinforces the substitution effect. This substitution effect refers to the response to the higher price when real income remains unchanged and consumers economise on the now more expensive good by replacing it with others.

To illustrate, suppose we are dealing with a poor country where the budget share of a certain food item is 10 percent so that $w_i = 0.1$, and the good has an income elasticity of $\eta_i = 0.8$. Then, the income effect is $-w_i\eta_i = -0.1 \times 0.8 = -0.08$, so, at the margin, 8 cents in the dollar is devoted to this good. A 50-percent price rise lowers real income by $0.1 \times 50 = 5$ percent and as the income elasticity is 0.8, this lead to a fall in consumption of the good of $0.8 \times 5 = 4$ percent. This is the income effect of the price change. If the uncompensated own-price elasticity $\eta_{ii} = -0.5$, as before, then, from equation (3), the corresponding compensated elasticity is $\eta_{ii}^* = \eta_{ii} + w_j\eta_i = -0.5 + 0.08 = -0.42$. On account of the substitution effect of a 50-percent price rise, consumption falls by $0.42 \times 50 = 21$ percent. Using the compensated elasticity η_{ii}^*, the price increase required to curb consumption by 25 percent is now $-25/\eta_{ii}^* = -25/(-0.42) \approx 60$ percent, rather than 50 percent if the uncompensated elasticity were used (see above). The difference is not huge, but still could be of some importance: One could imagine the reaction of fast-food providers to a tax of 60 percent, rather than 50 percent!

Combining equations (2) and (3) and using $\Sigma_{i=1}^n w_i = 1$, demand homogeneity implies that sums of the compensated elasticities are zero:

$$(4) \qquad \sum_{j=1}^{n} \eta_{ij}^* = 0, \quad i = 1, ..., n.$$

A final result from consumption theory is that the substitution effects of price changes are symmetric. That is, when real income is held constant, the effects of an increase in the price of a bottle of beer on the quantity of wine consumed is the same that the impact of a rise in

the price of a bottle of wine on beer consumption. This is known as Slutsky symmetry and can be expressed as

(5) $w_i \eta_{ij}^* = w_j \eta_{ji}^*, \ \ i, j = 1, \ldots, n.$

3. Application to Food

To make the problem of deriving the compensated price elasticities from their uncompensated counterparts manageable, we make the simplifying assumption that there is a limited degree of substitutability among the seven food items. In particular, the marginal utility of consumption of each of good is taken to be independent of the consumption of the others, a condition known as preference independence. While this is restrictive, in view of the broad nature of the food items ("Fruit and Vegetables", "Fish", "Meat", etc.), it is not completely unreasonable to suppose that there is not too much substitution among them. This does not mean there is no substitutability, only that it is restricted. In any event, this assumption is necessary for much of what is to follow and the proof of the pudding is in the eating. As shown in the Appendix, preference independence implies the compensated elasticities are related to the income elasticities according to

(6) $\eta_{ij}^* = \phi \eta_i \left(\delta_{ij} - w_j \eta_j \right), \ i, j = 1, \ldots, n,$

where δ_{ij} is the Kronecker delta (= 1 if i = j, 0 otherwise) and $\phi < 0$ is the reciprocal of the income elasticity of the marginal utility of income (the "income flexibility").

To interpret equation (6), consider the own-price elasticity so that i = j, $\delta_{ij} = 1$ and $\eta_{ii}^* = \phi \eta_i \left(1 - w_i \eta_i \right)$. As $w_i \eta_i$ is the MPC for good i, its complement, $1 - w_i \eta_i$, is the MPC for all other goods. Thus, equation (6) states that the own-price elasticity of good i is proportional to the product of its income elasticity, η_i, and the MPC for all other goods, with ϕ the factor of proportionality. Next, for the cross-price elasticity, $i \neq j$, $\delta_{ij} = 0$ and according to equation (6), $\eta_{ij}^* = -\phi \eta_i w_j \eta_j$, which is proportional to the product of the income elasticity of good i and the MPC for good j. Preference independence also implies that the income elasticities are positive (see Appendix), which, as $\phi < 0$, means that $\eta_{ij}^* > 0$, $i \neq j$. In words, under preference independence goods are substitutes on the basis of the sign of the compensated cross-price elasticity.

Guidance regarding the value of the income elasticity of all food (η_F) is available from the literature. Less is known about the income elasticities of the 7 food items $\eta_1,...,\eta_7$, but these are linked to η_F by

$$(7) \qquad \sum_{i=1}^{7}\left(\frac{w_i}{W_F}\right)\eta_i = \eta_F,$$

where $W_F = \Sigma_{i=1}^{7} w_i$ is the budget share of all food. In words, a weighted average of the income elasticities of the food items equals the overall food income elasticity, with weights equal to the budget shares within the food budget.

Substituting equation (6) into (3) gives $\eta_{ij} = \phi\eta_i\left(\delta_{ij} - w_j\eta_j\right) - w_j\eta_i$, which holds for $i, j = 1,...,7$. The "known" variables here are uncompensated elasticities η_{ij}, from Cornelsen et al. (2014), and the budget shares w_j, which we derive from the 2005 International Comparison Program (World Bank, unpublished). The "unknown" variables are the seven income elasticities $\eta_1,...,\eta_7$ and the income flexibility ϕ. This system of $7 \times 7 = 49$ equations is overdetermined and has no exact solution. Thus, we add an error term (ε_{ij}) to give $\eta_{ij} = \phi\eta_i\left(\delta_{ij} - w_j\eta_j\right) - w_j\eta_i + \varepsilon_{ij}$ and then minimise the sum of squared errors $\sum_{i=1}^{7}\sum_{j=1}^{7}\varepsilon_{ij}^2$. That is, the problem is

$$(8) \qquad \text{Min}_{\eta_1,...,\eta_7,\phi}\sum_{i=1}^{7}\sum_{j=1}^{7}\left[\eta_{ij} - \phi\eta_i\left(\delta_{ij} - w_j\eta_j\right) + w_j\eta_i\right]^2,$$

subject to equation (7) with a given value of η_F. We also impose the constraint that the income elasticities are all positive.

Table 2 gives the budget shares for the food items and the total, as well as the food income elasticity, from Gao (2012). Three comments can be made. First, column 9 reveals that low-income countries on average spend 35 percent of their income on food, while this falls to 9 percent for the high-income countries. This decline in the food share reflects Engel's law. Second, cereals are clearly the single more important food item in low-income countries (column 6) with a budget share of 11 percent. For the high-income countries, there is more diversification of food spending, with no single commodity clearly dominating. In other words, increasing income brings greater variety in consumption. Third, the food income elasticity is always less than unity and falls substantially with income (column 10).

The solution to problem (8) yields estimates of seven income elasticities and the income flexibility, to be denoted by $\hat{\eta}_1,...,\hat{\eta}_7$ and $\hat{\phi}$. There are then two ways of deriving the compensated elasticities:

- *Approach I*: Substitute into the preference independence relationship equation (6) the estimates of the income elasticities and the income flexibility, together with the budget shares. This gives the estimated compensated elasticities, $\hat{\eta}_{ij}^{*} = \hat{\phi}\hat{\eta}_i\left(\delta_{ij} - w_j\hat{\eta}_j\right)$, $i, j = 1,...,7$.
- *Approach II*: Rearrange of the Slutsky equation (3) as $\eta_{ij}^{*} = \eta_{ij} + w_j\eta_i$ and then substitute into the right-hand side the uncompensated elasticities from Cornelsen et al. (2014), the budget shares and the estimates of the income elasticities. This gives an alternative set of estimated compensated elasticities, $\tilde{\eta}_{ij}^{*} = \eta_{ij} + w_j\hat{\eta}_i$, $i, j = 1,...,7$.

The difference between the two approaches is that the second does not rely so much on the assumption of preference independence as equation (6) is bypassed. Thus, this approach is possibly to be preferred as it is somewhat more general. However, as minimisation problem (8) is based on preference independence, that assumption still plays a role in determining the estimated income elasticities. A further difference is that the estimates from Approach I satisfy the constraints from consumption theory (4) and (5), while this is not the case for Approach II.[3] In what follows, we present the results from the two approaches.

4. Results

The estimated income elasticities and income flexibility are given in Table 3 and four features can be noted. First, all the food income elasticities are less than unity, so the goods are necessities. Second, for each of the three income groups, the item "Fish" has the highest income elasticity, whilst "Cereals" and "Fats and oils" have the lowest and thus viewed as more of necessities by consumers. Third, the income elasticity for each item decreases with income, a reflection of the decline in the income elasticity for all food mentioned above (Table 2). Fourth, the absolute value of the income flexibility increases with income, which supports the famous conjecture by Frisch (1959, p. 189). However, the ϕ-values of Table 3

[3] The two approaches give identical results when $\hat{\phi}\hat{\eta}_i\left(\delta_{ij} - w_j\hat{\eta}_j\right) = \eta_{ij} + w_j\hat{\eta}_i$. A set of sufficient conditions for this is when the income flexibility equals –1, each income elasticity is unity, each uncompensated own-price elasticity –1 and each uncompensated cross-price elasticity zero. These are restrictive conditions.

are somewhat larger in absolute value than the centre of gravity of previous estimates (Clements and Zhao, 2009, pp. 227-29).

The estimated compensated price elasticities under Approach I are given in Table 4. Thus, for example, the compensated own-price elasticity for Fruit and Vegetables is -0.669, while the corresponding uncompensated version (from Table 1) was -0.720. Panel A of Table 5 reports these differences for each of the seven foods; these differences are the income effects of the price changes. Three comments can be made. First, as discussed above, the size of the income effect depends on the relative importance of the good in the budget (its budget share) and the income elasticity. As both these concepts take only modest values in the case of the seven food items, the income effects will also be modest, as Table 5 reveals. Second, the largest income effect (in absolute value) is for meat in low-income countries. From the third element of column 3 of the table, the income effect is -0.052, which means that a 25-percent increase in meat prices lowers real income such that meat consumption falls by 1.3 percent. The value of this income effect is reasonably close to the product of the budget share of meat in these countries, 0.068 (first element of column 3 of Table 2), and the corresponding income elasticity, 0.888 (first element of column 3 of Table 3). Third, all income effects decline in absolute value as we move from low- to medium- to high-income countries. The reason is that as income rises, the budget share and the income elasticity of each food item declines.[4]

Table 6 gives the results from Approach II. Compared to Approach I, there is a tendency for the absolute values of the elasticities to be lower, but most of the differences are small. The only exception is when the elasticity involves a change in the price of cereals: Here, the differences are larger, especially for the low-income countries, reflecting the large budget share of this good. Panel B of Table 5 contains the Approach II income effects, which are, of course, quite similar to those from Approach I (in panel A), except for the case of cereals in low-income countries.

For both approaches, each elasticity declines (in absolute value) as income rises. The own-price elasticity for sweets from Approach II, for example, is -0.722 in low-income

[4] Using the estimates of the compensated elasticites from Approach I, together with the budget shares and the estimated income elasticities, in equation (3) gives estimates of the uncompensated elasticities, $\hat{\eta}_{ij}$. As shown in the Appendix, the estimated own-price uncompensated elasticities are very close to their actual counterparts. However, the estimated cross-price elasticities are a good distance away from the actuals. This reflects the nature of problem (8): The own-price elasticities from Cornelsen et al. (2014) are large relative to the own-price elasticities, so the squared errors of the former also tend to be relatively large. As all the squared errors (the own- and cross-price ones) are summed, the solution to the minimisation problem emphasises accurate prediction the own-price elasticities at the expense of the cross-price elasticities. Such an implication is not unreasonable as the own-price elasticities are more economically important than the cross-price ones.

countries, -0.673 in medium-income countries and -0.557 in high-income countries. This decline in the compensated elasticties is consistent with Timmer's (1980) hypothesis of "curvature in the Slutsky matrix".[5]

In summary, the two approaches yield broadly similar results. As Approach II is possibly less restrictive, we tend to favour the compensated elasticities presented in Table 6.

5. Concluding Comments

When the objective is to use a tax instrument to limit consumption of a certain item by raising its price to consumers, the value of the price elasticity of demand is key. The rule is

$$\text{Required price increase} = \frac{\text{Requred reduction in consumption}}{\text{Price elasticity}}.$$

For example, a 25-percent reduction in consumption requires a 50-percent price increase if the elasticity is -1/2. There are two type of price elasticity, (i) the uncompensated version that holds constant consumers' money (or nominal) income; and (ii) the compensated version in which real income is constant. Both of these are valuable and which one should be used depends on the specifics of the policy environment, as discussed in this note.

Cornelsen et al. (2014) and Green et al. (2013) made a major contribution in reviewing a large number of recent studies of food demand and summarising the price elasticities for seven important food items with a meta-regression approach. In this note, we showed how to covert these uncompensated elasticities into their compensated counterparts. The difference between the two elasticities depends on the relative importance of the good in consumers' budgets and the income elasticity. In the case of the seven food items, these differences are not large, but still the compensated elasticities could be of some use.

[5] There is a similar decline in the uncompensated elasticties of Table 1. This is another reflection of the modest income effects.

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Table 1 Uncompensated price elasticities

Commodity	Fruits & vegetables	Meat	Fish	Dairy	Cereals	Fats and oils	Sweets	Non-Food
				A. Low Income				
Fruits & vegetables	-0.720	0.005	-0.014	-0.001	0.065	-0.014	0.112	-
Meat	0.020	-0.780	-0.008	0.011	0.062	0.016	0.101	-
Fish	0.014	0.045	-0.800	-0.003	0.092	0.031	0.098	-
Dairy	-0.001	0.003	-0.020	-0.780	0.117	0.042	0.108	-
Cereals	0.009	0.003	-0.010	0.068	-0.610	0.006	0.100	-
Fats and oils	0.012	-0.043	-0.061	0.022	0.071	-0.600	0.094	-
Sweets	0.022	0.003	-0.004	0.033	0.074	0.022	-0.740	-
Non-Food	-	-	-	-	-	-	-	-
				B. Medium Income				
Fruits & vegetables	-0.650	-0.026	-0.079	-0.058	0.007	-0.039	0.034	-
Meat	0.001	-0.720	-0.073	-0.045	0.005	-0.010	0.024	-
Fish	-0.004	0.014	-0.730	-0.059	0.035	0.005	0.021	-
Dairy	-0.020	-0.028	-0.085	-0.720	0.060	0.016	0.031	-
Cereals	-0.010	-0.028	-0.076	0.012	-0.550	-0.020	0.023	-
Fats and oils	-0.006	-0.074	-0.126	-0.035	0.014	-0.540	0.017	-
Sweets	0.003	-0.028	-0.069	-0.024	0.017	-0.003	-0.680	-
Non-Food	-	-	-	-	-	-	-	-
				C. High Income				
Fruits & vegetables	-0.530	0.002	0.010	-0.030	0.048	-0.033	0.060	-
Meat	-0.009	-0.600	0.016	-0.018	0.045	-0.003	0.049	-
Fish	-0.015	0.042	-0.610	-0.032	0.075	0.012	0.046	-
Dairy	-0.030	0.001	0.004	-0.600	0.100	0.023	0.057	-
Cereals	-0.020	0.000	0.013	0.039	-0.430	-0.013	0.048	-
Fats and oils	-0.017	-0.046	-0.037	-0.007	0.054	-0.420	0.043	-
Sweets	-0.007	0.000	0.020	0.004	0.057	0.003	-0.560	-
Non-Food	-	-	-	-	-	-	-	-

Note:
The commodity column label refers to the good whose price changes, while the row label refers to the good whose quantity changes in response. Thus, for example, from the first row of panel A, the own-price elasticity of demand for Fruits and Vegetables is -0.720, while the price elasticity of demand for Fruit and Vegetables with respect to the price of Cereals is 0.065.
Source:
Cornelsen et al. (2014), who use a meta-regression approach. Income groups are defined by real income per capita relative to the United States. See the Appendix for details. Two typographic errors regarding signs in Table 3 of Cornelsen et al. (2014) have been corrected (the own-price elasticities for “Meat” and “Fish”). These errors were confirmed in correspondence with Rosemary Green**,** one of the authors of that study.

Table 2 Food budget shares and income elasticities

Income group	Budget shares w_i, W_F								Food income elasticity η_F
	Fruits & vegs	Meat	Fish	Dairy	Cereals	Fats and oils	Sweets	Total food	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Low	0.089	0.068	0.030	0.030	0.112	0.024	0.021	0.353	0.819
Medium	0.042	0.051	0.010	0.025	0.036	0.009	0.013	0.186	0.517
High	0.020	0.023	0.008	0.012	0.016	0.003	0.008	0.089	0.313

Notes:
1. Budget shares are calculated using the disaggregated expenditure data from the unpublished International Comparison Program (ICP) dataset supplied by the World Bank (unpublished). See the Appendix for details.
2. Food income elasticities from Gao (2012) are averaged across countries by income group.

Table 3 Estimated income elasticities

Income group	Income elasticities η_i								Income flexibility ϕ
	Fruits & vegs	Meat	Fish	Dairy	Cereals	Fats and oils	Sweets	Non-food	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Low	0.827	0.888	0.902	0.886	0.756	0.681	0.851	1.108	-0.873
Medium	0.508	0.560	0.573	0.564	0.432	0.426	0.537	1.110	-1.265
High	0.304	0.344	0.351	0.345	0.248	0.242	0.322	1.067	-1.736

Table 4 Compensated price elasticities, Approach I

Group	Fruits & vegetables	Meat	Fish	Dairy	Cereals	Fats and oils	Sweets	Non-Food
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				A. Low Income				
Fruits & vegetables	-0.669	0.043	0.019	0.019	0.061	0.012	0.013	0.500
Meat	0.057	-0.728	0.021	0.021	0.066	0.013	0.014	0.537
Fish	0.058	0.047	-0.766	0.021	0.067	0.013	0.014	0.546
Dairy	0.057	0.047	0.021	-0.753	0.065	0.013	0.014	0.536
Cereals	0.048	0.040	0.018	0.018	-0.604	0.011	0.012	0.458
Fats and oils	0.044	0.036	0.016	0.016	0.050	-0.585	0.011	0.413
Sweets	0.055	0.045	0.020	0.020	0.063	0.012	-0.729	0.515
Non-Food	0.071	0.058	0.026	0.026	0.082	0.016	0.018	-0.296
				B. Medium Income				
Fruits & vegetables	-0.629	0.018	0.004	0.009	0.010	0.002	0.004	0.581
Meat	0.015	-0.688	0.004	0.010	0.011	0.003	0.005	0.641
Fish	0.015	0.021	-0.721	0.010	0.011	0.003	0.005	0.656
Dairy	0.015	0.020	0.004	-0.703	0.011	0.003	0.005	0.645
Cereals	0.012	0.016	0.003	0.008	-0.538	0.002	0.004	0.495
Fats and oils	0.011	0.015	0.003	0.007	0.008	-0.537	0.004	0.487
Sweets	0.014	0.019	0.004	0.009	0.011	0.003	-0.674	0.614
Non-Food	0.030	0.040	0.008	0.019	0.022	0.005	0.010	-0.135
				C. High Income				
Fruits & vegetables	-0.524	0.004	0.001	0.002	0.002	0.000	0.001	0.512
Meat	0.004	-0.593	0.002	0.002	0.002	0.000	0.002	0.581
Fish	0.004	0.005	-0.607	0.002	0.002	0.000	0.002	0.592
Dairy	0.004	0.005	0.002	-0.596	0.002	0.000	0.002	0.581
Cereals	0.003	0.003	0.001	0.002	-0.428	0.000	0.001	0.418
Fats and oils	0.002	0.003	0.001	0.002	0.002	-0.419	0.001	0.408
Sweets	0.003	0.004	0.002	0.002	0.002	0.000	-0.558	0.544
Non-Food	0.011	0.014	0.005	0.008	0.007	0.001	0.005	-0.052

Notes:

1. According to Approach I, the compensated price elasticities are derived from equation (6) as $\hat{\eta}_{ij}^{*} = \hat{\phi}\hat{\eta}_i\left(\delta_{ij} - w_j\hat{\eta}_j\right)$, $i, j = 1, ..., 7$, where $\hat{\phi}$ is the value of the income flexibility that solves minimisation problem (8), $\hat{\eta}_i$ is the corresponding income elasticity of good i, δ_{ij} is the Kronecker delta and w_j is the budget share of j.
2. To complete the demand system, the remaining goods in the consumption basket are summarised in a "non-food" group, so now there are $n = 7 + 1 = 8$ goods. The eight income elasticities η_i are related according to $\Sigma_{i=1}^{8} w_i\eta_i = 1$, so that the estimated non-food income elasticity is $\hat{\eta}_8 = \left(1/w_8\right)\left(1 - \Sigma_{i=1}^{7} w_i\hat{\eta}_i\right)$, with $w_8 = 1 - \Sigma_{i=1}^{7} w_i$ the non-food budget share. The above approach is then applied to compute the elasticities involving non-food.

Table 5 Income effect of price change

Group	Fruits & vegetables	Meat	Fish	Dairy	Cereals	Fats and oils	Sweets
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. APPROACH I							
i. Low Income							
Uncompensated elasticity η_{ii}	-0.720	-0.780	-0.800	-0.780	-0.610	-0.600	-0.740
Compensated elasticity $\hat{\eta}_{ii}^{*}$	-0.669	-0.728	-0.766	-0.753	-0.604	-0.585	-0.729
Income effect	-0.051	-0.052	-0.034	-0.027	-0.006	-0.015	-0.011
ii. Medium Income							
Uncompensated elasticity η_{ii}	-0.650	-0.720	-0.730	-0.720	-0.550	-0.540	-0.680
Compensated elasticity $\hat{\eta}_{ii}^{*}$	-0.629	-0.688	-0.721	-0.703	-0.538	-0.537	-0.674
Income effect	-0.021	-0.032	-0.009	-0.017	-0.012	-0.003	-0.006
iii. High Income							
Uncompensated elasticity η_{ii}	-0.530	-0.600	-0.610	-0.600	-0.430	-0.420	-0.560
Compensated elasticity $\hat{\eta}_{ii}^{*}$	-0.524	-0.593	-0.607	-0.596	-0.428	-0.419	-0.558
Income effect	-0.006	-0.007	-0.003	-0.004	-0.002	-0.001	-0.002
B. APPROACH II							
i. Low Income							
Uncompensated elasticity η_{ii}	-0.720	-0.780	-0.800	-0.780	-0.610	-0.600	-0.740
Compensated elasticity $\tilde{\eta}_{ii}^{*}$	-0.647	-0.720	-0.773	-0.753	-0.525	-0.583	-0.722
Income effect	-0.073	-0.060	-0.027	-0.027	-0.085	-0.017	-0.018
ii. Medium Income							
Uncompensated elasticity η_{ii}	-0.650	-0.720	-0.730	-0.720	-0.550	-0.540	-0.680
Compensated elasticity $\tilde{\eta}_{ii}^{*}$	-0.629	-0.691	-0.724	-0.706	-0.534	-0.536	-0.673
Income effect	-0.021	-0.029	-0.006	-0.014	-0.016	-0.004	-0.007
iii. High Income							
Uncompensated elasticity η_{ii}	-0.530	-0.600	-0.610	-0.600	-0.430	-0.420	-0.560
Compensated elasticity $\tilde{\eta}_{ii}^{*}$	-0.524	-0.592	-0.607	-0.596	-0.426	-0.419	-0.557
Income effect	-0.006	-0.008	-0.003	-0.004	-0.004	-0.001	-0.003

Notes:
1. The uncompensated elasticities are from Table 1.
2. The compensated elasticities in panels A and B are from Tables 4 and 6, respectively.
3. The income effect is the difference between the uncompensated and compensated elasticities.

Table 6 Compensated price elasticities, Approach II

Group	Fruits & vegetables	Meat	Fish	Dairy	Cereals	Fats and oils	Sweets	Non-Food
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				A. Low Income				
Fruits & vegetables	-0.647	0.061	0.011	0.024	0.158	0.006	0.130	-
Meat	0.099	-0.720	0.018	0.038	0.161	0.038	0.120	-
Fish	0.094	0.106	-0.773	0.024	0.193	0.053	0.117	-
Dairy	0.078	0.063	0.006	-0.753	0.216	0.064	0.127	-
Cereals	0.076	0.054	0.013	0.091	-0.525	0.024	0.116	-
Fats and oils	0.073	0.003	-0.041	0.042	0.147	-0.583	0.109	-
Sweets	0.098	0.061	0.021	0.058	0.169	0.043	-0.722	-
Non-Food	-	-	-	-	-	-	-	-
				B. Medium Income				
Fruits & vegetables	-0.629	0.000	-0.074	-0.045	0.025	-0.035	0.041	-
Meat	0.024	-0.691	-0.067	-0.031	0.025	-0.005	0.031	-
Fish	0.020	0.043	-0.724	-0.045	0.056	0.010	0.028	-
Dairy	0.004	0.001	-0.079	-0.706	0.080	0.021	0.038	-
Cereals	0.008	-0.006	-0.072	0.023	-0.534	-0.016	0.029	-
Fats and oils	0.012	-0.052	-0.122	-0.025	0.029	-0.536	0.023	-
Sweets	0.026	-0.001	-0.064	-0.011	0.036	0.002	-0.673	-
Non-Food	-	-	-	-	-	-	-	-
				C. High Income				
Fruits & vegetables	-0.524	0.009	0.012	-0.026	0.053	-0.032	0.062	-
Meat	-0.002	-0.592	0.019	-0.014	0.051	-0.002	0.052	-
Fish	-0.008	0.050	-0.607	-0.028	0.081	0.013	0.049	-
Dairy	-0.023	0.009	0.007	-0.596	0.106	0.024	0.060	-
Cereals	-0.015	0.006	0.015	0.042	-0.426	-0.012	0.050	-
Fats and oils	-0.012	-0.041	-0.035	-0.004	0.058	-0.419	0.045	-
Sweets	-0.001	0.007	0.023	0.008	0.062	0.004	-0.557	-
Non-Food	-	-	-	-	-	-	-	-

Note:

Denote by η_{ij} the $(i,j)^{th}$ uncompensated price elasticity from Cornelsen et al. (2014), reproduced in Table 1, w_j the budget share of j and $\hat{\eta}_i$ the estimated value of the i^{th} income elasticity. According to Approach II, the compensated price elasticities are derived from a rearrangement of equation (3): $\tilde{\eta}_{ij}^{*} = \eta_{ij} + w_j \hat{\eta}_i,\ i, j = 1, \ldots, 7.$

Appendix

Preference Independence

Under preference independence, the consumer's utility function is (some increasing function of) the sum of n sub-utility functions, one for each good: $u(q_1,...,q_n)=\Sigma_{i=1}^{n}u_i(q_i)$, with $u_i(\cdot)$ the i^{th} sub-utility function that depends only on the consumption of good i, q_i. Preference independence implies that each marginal utility depends only on the consumption of the good in question, not the others, so that all second-order cross derivatives of the utility function vanish. As goods do not interact, utility is derived from the consumption of good 1 and good 2 and good 3, and so on, where the word "and" is underlined to emphasise the additive nature of preferences.

Given the prices, $p_1,\ldots,p_n$, the consumer chooses the consumption basket, $q_1,\ldots,q_n$, to maximise utility, $\Sigma_{i=1}^{n}u_i(q_i)$, subject to the budget constraint, $M=\Sigma_{i=1}^{n}p_iq_i$ (M is known as "income" for short). Differentiating the budget constraint with respect to income and p_j yields $\Sigma_{i=1}^{n}\partial(p_iq_i)/\partial M=1$ and $\Sigma_{i=1}^{n}p_i(\partial q_i/\partial p_j)+q_j=0$, which can be expressed as

$$\text{(A1)}\quad \sum_{i=1}^{n}w_i\eta_i=1,\qquad \sum_{i=1}^{n}w_i\eta_{ij}+w_j=0,$$

where $w_i=p_iq_i/M$ is the budget share of good i, $\eta_i=\partial\log q_i/\partial\log M$ is the income elasticity of i and $\eta_{ij}=\partial\log q_i/\partial\log p_j$ is the $(i,j)^{th}$ uncompensated price elasticity.

Denoting by λ the marginal utility of income, the i^{th} first-order condition for a budget-constrained utility maximum is $\log u_i'=\log\lambda+\log p_i$, where the prime denotes a first derivative. Using $\Sigma_{i=1}^{n}u_i(q_i)$, we differentiate the first-order condition with respect to $\log M$ and $\log p_j$ to yield

$$\frac{\partial\log u_i'}{\partial\log q_i}\eta_i=\phi^{-1},\quad \frac{\partial\log u_i'}{\partial\log q_i}\eta_{ij}=\frac{\partial\log\lambda}{\partial\log p_j}+\delta_{ij},$$

where ϕ^{-1} is the income elasticity of λ and δ_{ij} is the Kronecker delta. Combining the above two equations gives

$$\text{(A2)}\quad \eta_{ij}=\phi\frac{\partial\log\lambda}{\partial\log p_j}\eta_i+\delta_{ij}\phi\eta_i,$$

which we multiply by the budget share of i, w_i, sum both sides over $i=1,\ldots,n$ to give

$$\sum_{i=1}^{n} w_i \eta_{ij} = \phi \frac{\partial \log \lambda}{\partial \log p_j} \sum_{i=1}^{n} w_i \eta_i + \phi \sum_{i=1}^{n} \delta_{ij} w_i \eta_i = \phi \frac{\partial \log \lambda}{\partial \log p_j} + \phi w_j \eta_j,$$

which follows from the first member of (A1). Combining this with the second member of (A1), gives $\partial \log \lambda / \partial \log p_j = -w_j \left(\eta_j + \phi^{-1} \right)$. Substituting the last equation back into (A2) yields

$$\eta_{ij} = \phi \eta_i \left(\delta_{ij} - w_j \eta_j \right) - w_j \eta_i.$$

In view of equation (3) of the text, the above equation means that the compensated price elasticity takes the form

(A3) $$\eta_{ij}^{*} = \phi \eta_i \left(\delta_{ij} - w_j \eta_j \right),$$

which is equation (6) of the text. For the compensated own-price elasticities to be negative (the law of demand), equation (A3) implies that the income elasticities are all positive.

In addition to the estimated compensated elasticities satisfying constraints (4) and (5), as stated in the text, the corresponding uncompensated elasticities and the income elasticities satisfy the constraints in (A1).

The ICP Data

Purchasing power parities and nominal expenditures on 129 disaggregated components of GDP in 146 countries are from the 2005 International Comparison Program (ICP) data (World Bank, unpublished). The 29 food categories and their broad group classifications are given in Table A1. The commodities in the last four rows of Table A1 would typically be considered as part of food consumption; however, Cornelsen et al. (2014) omit price elasticities for “Eggs” and “Other foods” due to the low number of observations for the former and the majority of observations coming from one study for the latter. Therefore, we omit these groups.

Of the 146 countries in the ICP data, 16 countries were dropped as they had little or no expenditure on certain food items, be it for income, geographical, religious or other reasons. Two more countries were also dropped as they did not submit national accounts data to the ICP. Lastly, four remaining countries were omitted as they did not appear in the Gao (2012), the source of the income elasticity for food. The number of countries is thus $146 - 16 - 2 - 4 = 124$ countries.

Income Groups

Countries are grouped by income using the approach of Cornelsen et al. (2014), which is based on Muhammad et al. (2011). They divide countries into low-, middle-, and high-income countries on the basis of their real income per capita relative to that of the United States, using the 2005 ICP data. Low-income countries are those with 15 percent or less income relative to the United States, middle-income are those between 15 and 45 percent, while high-income countries have income equal to or greater than 45 percent the United States. We cross-checked our 124 countries with those reported Muhammad et al. (2011) to ensure income groups are properly assigned and they agree with the dataset that Cornelsen et al. (2014) sent us. The 124 countries, and the income groupings, are listed in Table A2 along with our own calculations of real income per capita. While this allocation of countries to income groups agrees with Cornelsen et al. (2014) and Muhammad et al. (2011), there are some minor inconsistencies with income. Our measure of real income per capita that is presented in Table A2 differs slightly from Muhammad et al. (2011). It is for this reason why some low-income countries have higher incomes than middle income countries. Take the case of country 58, Tajikistan, which has an income of $7,010 and is classified as a low-income country. But this income is higher than that of countries 59-66, all of which are classified as middle-income countries. A similar problem occurs with countries near the high-income "border". We judge this issue to be of relatively minor importance that is unlikely to have a substantial impact on the results.

The Estimated Elasticites

Table A3 contains the estimated uncompensated elasticities using Approach I. These are obtained from equation (3) by using in the right-hand side the estimated compensated elasticities of Table 4 and the budget shares and income elasticities of Tables 2 and 3, respectively. Figure A1 demonstrates that for the own-price uncompensated elasticities, the estimates from Approach I and actual values are in close agreement, with the possible exception of Cereals. As for Approach II actual and estimated coincide, a similar comparison is not meaningful.

Figure A2 confirms the closeness of the two sets of results – Approach I and Approach II -- for the own-price elasticities. The only item some distance away from the 45-degree line is Cereals.

Table A1 ICP Basic Headings

No. (1)	ICP Category (2)	Assigned Group (3)
1.	1101111 Rice	Cereals
2.	1101112 Other cereals and flour	Cereals
3.	1101113 Bread	Cereals
4.	1101114 Other bakery products	Cereals
5.	1101115 Pasta products	Cereals
6.	1101121 Beef and veal	Meat
7.	1101122 Pork	Meat
8.	1101123 Lamb, mutton and goat	Meat
9.	1101124 Poultry	Meat
10.	1101125 Other meats and preparations	Meat
11.	1101131 Fresh or frozen fish and seafood	Fish
12.	1101132 Preserved fish and seafood	Fish
13.	1101141 Fresh milk	Dairy
14.	1101142 Preserved milk and milk products	Dairy
15.	1101143 Cheese	Dairy
16.	1101151 Butter and margarine	Fats and oils
17.	1101153 Other edible oils and fats	Fats and oils
18.	1101161 Fresh or chilled fruit	Fruits and vegetables
19.	1101162 Frozen, preserved or processed fruits	Fruits and vegetables
20.	1101171 Fresh or chilled vegetables	Fruits and vegetables
21.	1101172 Fresh or chilled potatoes	Fruits and vegetables
22.	1101173 Frozen or preserved vegetables	Fruits and vegetables
23.	1101181 Sugar	Sweets
24.	1101182 Jams, marmalades and honey	Sweets
25.	1101183 Confectionery, chocolate and ice cream	Sweets
26.	1101144 Eggs and egg-based products	Omitted
27.	110119 Food products n.e.c.	Omitted
28.	110121 Coffee, tea and cocoa	Omitted
29.	110122 Mineral waters, soft drinks, fruit and vegetable juices	Omitted

Source: World Bank (unpublished).

Table A2 Countries by income group

#	Country	Real income per capita. ($US, PPP)	#	Country	Real income per capita ($US, PPP)
(1)	(2)	(3)	(4)	(5)	(6)
	A. Low Income		63.	Uruguay	6,477
1.	Guinea-Bissau	338	64.	South Africa	6,720
2.	Niger	362	65.	Montenegro	6,893
3.	Liberia	420	66.	Bosnia and Herzegovina	6,921
4.	Mozambique	458	67.	Chile	7,160
5.	Central African Republic	473	68.	Macedonia, FYR	7,171
6.	Rwanda	669	69.	Argentina	7,175
7.	Malawi	696	70.	Oman	7,302
8.	Burkina Faso	704	71.	Saudi Arabia	7,834
9.	Nepal	704	72.	Ukraine	8,195
10.	Côte d'Ivoire	803	73.	Romania	8,678
11.	Madagascar	844	74.	Serbia	9,128
12.	Sierra Leone	905	75.	Iran, Islamic Rep.	9,137
13.	Senegal	928	76.	Bulgaria	9,204
14.	Guinea	928	77.	Mauritius	9,428
15.	Benin	955	78.	Mexico	9,649
16.	Ghana	984	79.	Croatia	10,223
17.	Mauritania	993	80.	Russian Federation	10,414
18.	Cameroon	1,158	81.	Kazakhstan	10,996
19.	Sudan	1,242	82.	Macao, China	11,235
20.	São Tomé and Principe	1,260	83.	Latvia	11,711
21.	Nigeria	1,276	84.	Bahrain	12,171
22.	Kenya	1,454	85.	Poland	12,212
23.	India	1,488	86.	Slovak Republic	12,230
24.	Cambodia	1,649	87.	Belarus	12,309
25.	Yemen, Rep.	1,710	88.	Lithuania	12,709
26.	Indonesia	1,844	89.	Estonia	12,764
27.	Congo, Rep.	1,870	90.	Korea, Rep.	13,533
28.	China	1,923	91.	Czech Republic	13,944
29.	Morocco	1,964	92.	Hungary	13,974
30.	Pakistan	1,975	93.	Slovenia	14,956
31.	Philippines	2,071	94.	Brunei Darussalam	15,380
32.	Vietnam	2,223	95.	Israel	17,537
33.	Iraq	2,271		C. High Income	
34.	Cape Verde	2,456	96.	Portugal	14,528
35.	Mongolia	2,663	97.	Kuwait	15,838
36.	Lesotho	2,715	98.	Cyprus	16,087
37.	Sri Lanka	2,781	99.	Singapore	16,471
38.	Paraguay	2,948	100.	Malta	16,911
39.	Syrian Arab Republic	3,330	101.	Greece	17,510
40.	Equatorial Guinea	3,636	102.	New Zealand	17,988
41.	Swaziland	3,709	103.	Qatar	18,230
42.	Fiji	3,785	104.	Spain	18,275
43.	Namibia	3,842	105.	Italy	18,433
44.	Peru	4,161	106.	Finland	20,322
45.	Ecuador	4,472	107.	Taiwan, China	20,430
46.	Bolivia	4,562	108.	Hong Kong, China	20,658
47.	Tunisia	4,616	109.	Germany	20,799
48.	Egypt, Arab Rep.	4,691	110.	Ireland	21,391
49.	Jordan	4,713	111.	Belgium	21,563
50.	Georgia	4,715	112.	France	21,966
51.	Gabon	4,870	113.	Japan	22,088
52.	Botswana	4,955	114.	Denmark	22,345
53.	Kyrgyz Republic	4,998	115.	Austria	22,471
54.	Azerbaijan	5,251	116.	Australia	22,519
55.	Albania	5,398	117.	Switzerland	22,828
56.	Armenia	5,584	118.	Canada	23,439
57.	Moldova	5,661	119.	Sweden	23,866
58.	Tajikistan	7,010	120.	United Kingdom	25,389
	B. Middle Income		121.	Norway	26,728
59.	Venezuela, RB	5,362	122.	Iceland	28,308
60.	Malaysia	5,794	123.	United States	29,999
61.	Turkey	6,139	124.	Luxembourg	33,057
62.	Brazil	6,201			

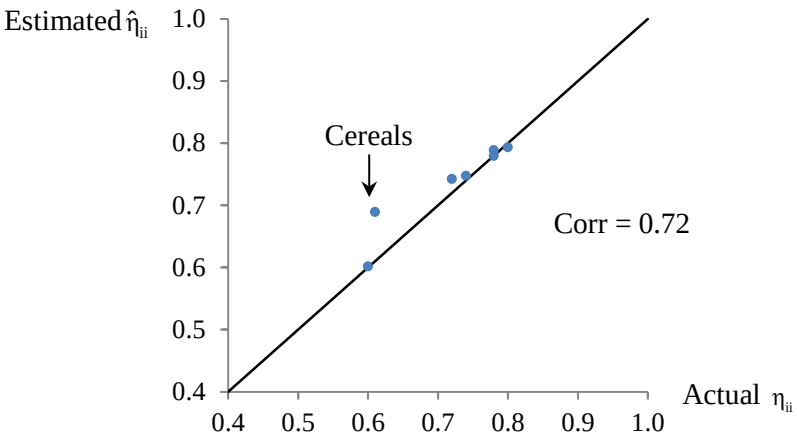
Note: Real income per capita in columns 3 and 6 is real total consumption, based on our own calculations using 2005 ICP data from the World Bank (unpublished). This is the sum over expenditures of the 116 consumption categories, each deflated by the population and the respective PPP.

Table A3 Estimated uncompensated price elasticities, Approach I

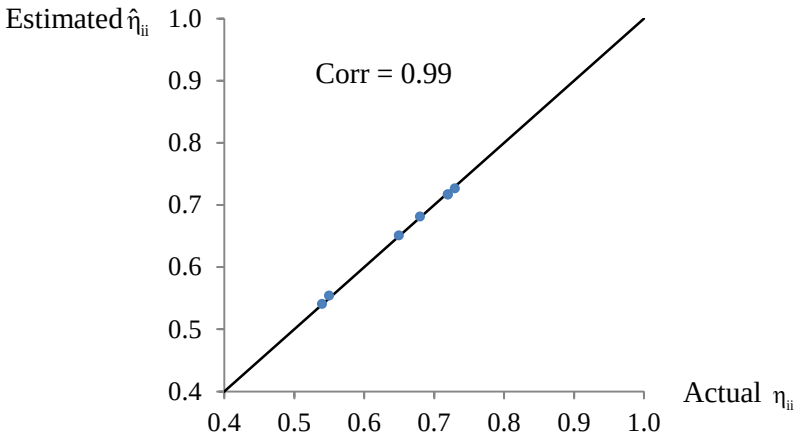
Group	Fruits & vegetables	Meat	Fish	Dairy	Cereals	Fats and oils	Sweets	Non-Food
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				A. Low Income				
Fruits & vegetables	-0.742	-0.013	-0.005	-0.006	-0.031	-0.008	-0.005	-0.017
Meat	-0.022	-0.788	-0.006	-0.006	-0.034	-0.009	-0.005	-0.018
Fish	-0.022	-0.014	-0.793	-0.006	-0.034	-0.009	-0.005	-0.019
Dairy	-0.022	-0.014	-0.006	-0.779	-0.034	-0.009	-0.005	-0.018
Cereals	-0.019	-0.012	-0.005	-0.005	-0.689	-0.007	-0.004	-0.016
Fats and oils	-0.017	-0.010	-0.004	-0.005	-0.026	-0.602	-0.004	-0.014
Sweets	-0.021	-0.013	-0.005	-0.006	-0.032	-0.008	-0.747	-0.017
Non-Food	-0.027	-0.017	-0.007	-0.008	-0.042	-0.011	-0.006	-0.990
				B. Medium Income				
Fruits & vegetables	-0.651	-0.008	-0.001	-0.004	-0.008	-0.002	-0.002	0.167
Meat	-0.008	-0.717	-0.002	-0.004	-0.009	-0.002	-0.002	0.185
Fish	-0.009	-0.009	-0.727	-0.004	-0.009	-0.002	-0.002	0.189
Dairy	-0.008	-0.008	-0.002	-0.717	-0.009	-0.002	-0.002	0.186
Cereals	-0.006	-0.006	-0.001	-0.003	-0.554	-0.002	-0.002	0.142
Fats and oils	-0.006	-0.006	-0.001	-0.003	-0.007	-0.541	-0.002	0.140
Sweets	-0.008	-0.008	-0.001	-0.004	-0.009	-0.002	-0.681	0.177
Non-Food	-0.017	-0.017	-0.003	-0.008	-0.018	-0.004	-0.005	-1.039
				C. High Income				
Fruits & vegetables	-0.530	-0.003	-0.001	-0.001	-0.003	-0.001	-0.001	0.236
Meat	-0.003	-0.601	-0.001	-0.002	-0.003	-0.001	-0.001	0.267
Fish	-0.003	-0.003	-0.610	-0.002	-0.003	-0.001	-0.001	0.272
Dairy	-0.003	-0.003	-0.001	-0.600	-0.003	-0.001	-0.001	0.267
Cereals	-0.002	-0.002	-0.001	-0.001	-0.432	0.000	-0.001	0.192
Fats and oils	-0.002	-0.002	-0.001	-0.001	-0.002	-0.420	-0.001	0.188
Sweets	-0.003	-0.003	-0.001	-0.002	-0.003	-0.001	-0.561	0.250
Non-Food	-0.010	-0.010	-0.003	-0.005	-0.010	-0.002	-0.004	-1.024

Figure A1 Estimated and actual own-price elasticities, Approach I

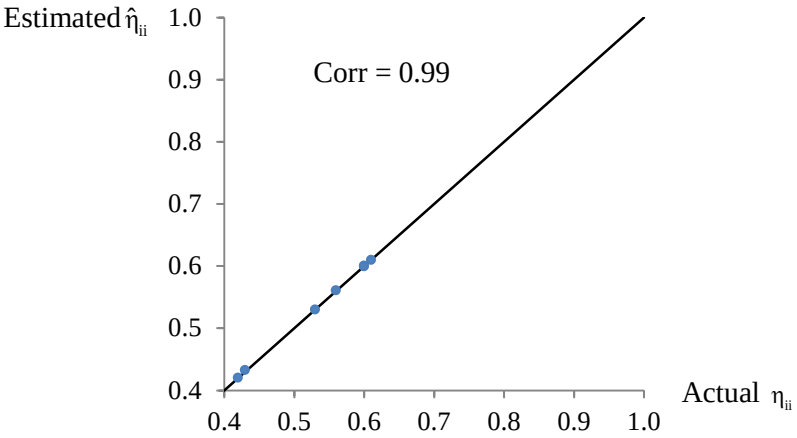
A. Low income



B. Medium income



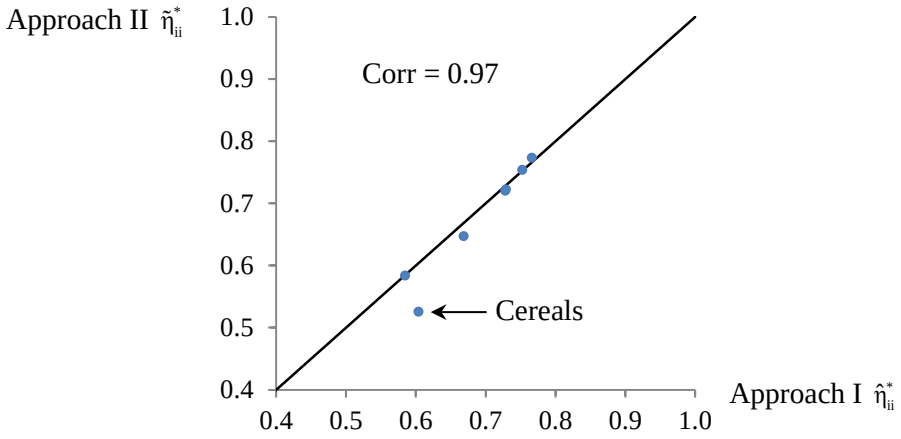
C. High income



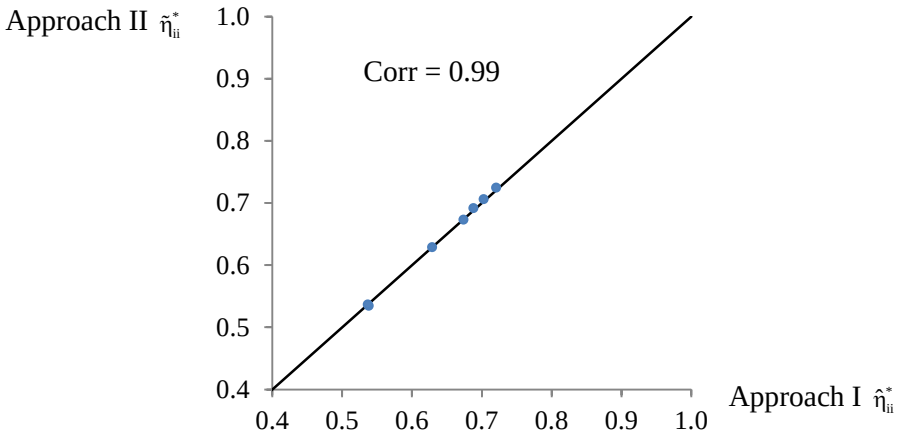
Note: Along the solid lines, estimated = actual. Actual and estimated uncompensated own-price elasticities are the diagonal elements of Tables 1 and A3, respectively.

Figure A2 Compensated own-price elasticities,
Approach I vs. Approach II

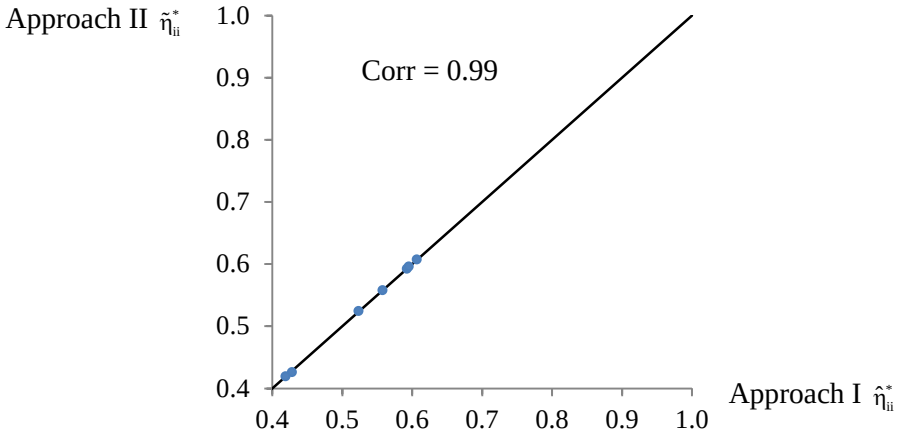
A. Low income



B. Medium income



C. High income



Notes: Along the solid lines, Approach I = Approach II. Approach I and II elasticities are the diagonal elements of Tables 4 and 6, respectively.

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