Grattan Institute's Case for Sugar Tax is Not Proven

Jonathan Pincus
University of Adelaide

adelaide.edu.au

seek LIGHT

1. Introduction

In a recent Grattan Institute report, Duckett and Swerissen (2016) advocated a tax on sugar-sweetened beverages (SSB). Unfortunately, Duckett and Swerissen did not provide a satisfactory framework for an economic evaluation of the proposed SSB tax, of a kind that would be included in a Regulatory Impact Statement, or in any competent Benefit-Cost Analysis, whether using a partial-equilibrium or a computable general equilibrium model. Significant items were omitted, and others misinterpreted, so that, even on their own mistaken criteria, and using their data, the case in favour of the tax is nugatory, at best.

The current paper does not attempt to provide a rounded discussion of the efficacy and incidence of such a tax, as in Gardiner (2016) for New Zealand. Instead, its sole aim is to test the strength and validity of the case put forward by Duckett and Swerissen. In that sense, it complements Ergas (2016), which pointed to a series of errors and weaknesses in the Duckett and Swerissen piece.

The proposed tax is meant to lessen the extent of 'failures' in the food market, with the main attention being on those caused by the individuals not bearing 'the full costs of the over-consumption of unhealthy foods' (Duckett and Swerissen 2016: p. 20): an obese individual's consumption of fattening foods places some costs on others that, in the usual terminology of economics, are called 'external' costs or negative 'externalities', but which Duckett and Swerissen called 'third party' costs. They list two other reasons for policy intervention—lack of knowledge, and irrationality (Duckett and Swerissen: 35), but do not pursue them further.

Most economists know that the existence of 'market failures' can never be a sufficient justification of a policy intervention, and Duckett and Swerissen duly mention, in a footnote, the 'third party' cost of the proposed tax that falls on the non-obese consumers of sugar sweetened beverages; however, they do not attempt to appraise these costs, but implicitly assume that they fall short of their estimate of the 'third party' benefits from the tax:

> While an SSB tax does not perfectly target the costs of excess unhealthy food consumption that contributes to obesity, as economic theory requires, it is a good second-best option to reduce consumption and recover some of the third-party costs of obesity.[83] (Duckett and Swerissen 2016: 25).[1]

Although Duckett and Swerissen cited Freebairn's (2010) careful theoretical exposition of the issues surrounding a tax on SSB, they did not use the apposite evaluative framework that Freebairn provided. Specifically, Freebairn showed how to take account of consumer heterogeneity, and made it clear that any such tax must ultimately be justified on quantitative or empirical grounds: whether or not a tax on unhealthy foods is 'a good second-best option' depends on the facts, interpreted within a suitable theoretical framework.

Applying Duckett and Swerissen data to Freebairn's framework, we show that theirs would be a 'nuisance' tax, with the economic benefits being small and about equal to the deadweight burden of the tax of around $60m a year (before

the undoubtedly significant costs of implementation and operation). Moreover, although Freebairn's framework omitted a benefit that was discussed by Duckett and Swerissen—a stimulus to the employment of those currently obese—its inclusion cannot rescue the economic case in favour of the SSB tax.

2. Evaluating a tax on sugar-sweetened beverages

Figure 1 is a slightly augmented copy of Freebairn's Fig. 3, depicting the market for a fattening food, with the left-hand panel relating to obese persons, and the right to the others.[2] It is assumed that the commodity is supplied at a constant price, as shown by the *MSC* curves at height *P.* With the imposition of a specific tax, *T*, the consumer price rises to $P' = (P + T)$. The demands of each group are shown by the downward-sloping demand curves, labelled *MPB*; the vertical gap between the *MPB* and *MSB* curves is the external cost per litre of consumption by the obese. The external cost is assumed to be constant over the relevant range.

It is important to note that these external costs are 'real' costs, like additional health expenses, and do not include transfer payments, like forgone income tax or pension payments. From the economy-wide viewpoint of the economic evaluation, transfer payments net out to zero. In contrast, external costs are a drain for the nation as a whole; they use labour, land and capital, which are real resources that could have been employed elsewhere within the economy.[3] Thus, 'external' costs are narrower than Duckett and Swerissen's 'third party' costs— about half, as it turns out.

Although the estimate of 'real' external costs should not include the budget cost of transfer payments, it should include the deadweight cost (or 'excess burden') of the tax revenue required to fund all additional public spending caused by obesity, including transfers. Duckett and Swerissen estimated the deadweight costs at $750m and classified them as 'third party' costs of obesity; however, they ultimately did not add them in their total of third party costs, not on grounds of principle but due to uncertainties and difficulty in obtaining data (Duckett and Swerissen 2016: 15, 55).[4]

The effect of the SSB tax is to reduce consumption from *Q* to *Q'* (in both panels). To proceed, we need an estimate of the share of SSB consumption attributable to obese people. Because we could not find one in Duckett and Swerissen, we assumed that the 28 per cent who are obese consume 50 per cent of the SSB. (We provide a sensitivity analysis.) This means that the tax induces the same fall in consumption by both groups, *Q'Q*, which is equal to 146ML (million litres: the data used are in Table 1).[5] The economic benefit of the tax is the fall in external costs, which is the shaded rectangle labelled *b*, with base *Q'Q* and height equal to the external cost per litre of consumption by the obese. Duckett and Swerissen estimated the total external costs of obesity, excluding transfers, at $2.6b,[6] while the reduction in the prevalence of obesity, due to the SSB tax, was put at two per cent (Duckett and Swerissen 2010: 52). Thus, an estimate of the external costs of SSB consumption is 0.02 × $2.6bn = $52m, which is the size of area *b*; the height of area *b* is the external cost per litre of consumption by the obese, which is

36¢/L. If we include their estimate, $750m, of the deadweight cost of the relevant tax revenue, then the reduction in external costs rises to $67m.

As to the calculation of the dead weight loss from the SSB tax: that falling on the non-obese is shown in Figure 1 as the triangular area denoted *c*, which has a height equal to the specific tax, 40¢, and a base *Q'Q* of 146ML, so *c* is $29m. However, there is also a dead weight loss (a reduction in consumer surplus) on the part of the obese consumers who, after all, consume SSB because they enjoy them; on our assumption of a 50/50 split of the SSB market, the sum of the two is $58m, twice that of the non-obese.[7]

On these admittedly crude estimates of economic costs and benefits, and ignoring the public and private costs of implementing and administering it, the tax falls short or just scrapes over the line. However, the Freebairn framework omits a benefit that can flow from the SSB tax, and which was discussed by Duckett and Swerissen, in the form of the additional labour force earnings of the formerly obese. These are analysed in section 5, where we argue that they would add negligibly to the case in favour.[8]

3. A tax on SSB would increase 'third party' costs, not reduce them

Thus, under the standard 'back-of-the-envelope' assessment of economic costs and benefits, the SSB tax proposed by Duckett and Swerissen should be rejected: the dead weight loss largely or more than offsets the reduction in external costs. On what grounds, then, did Duckett and Swerissen support the tax; and how valid are they?

 As indicated by the quotation given earlier, Duckett and Swerissen asserted that the SSB tax is good policy because it reduces the costs that obesity imposes on 'third parties', which they define as the non-obese.[9] However, on this criterion and their data, the proposed tax fails by a large margin.

As discussed, the Duckett and Swerissen definition of 'third party' costs includes transfer payments—income tax forgone because of obesity, and Disability Pension payments—so their number for the total of 'third party' costs is $5.3bn (Duckett and Swerissen 2016: 52). Again employing Duckett and Swerissen's estimate that the SSB tax would reduce the prevalence of obesity by two per cent, and assuming this would reduce 'third party' costs by two per cent, the benefit to 'third parties' would be $106m.

In section 6, we argue that a two per cent reduction in the prevalence of obesity would have an effect, on the consequences of obesity, which is much smaller than two per cent; for that reason alone, $106m should be regarded as an upper bound. Moreover, as is spelled out in section 4, Duckett and Swerissen assume that none of the external costs of one person's obesity falls on other obese persons: the obese twenty-eight per cent of the population are assumed, somehow, to insulated from these spillover costs. In this sense, Duckett and

Swerissen have appreciably overstated the burden of obesity on the non-obese, which is the main motivation of their policy advocacy.

Returning now to the calculations, the SSB tax in itself was estimated to raise $500m (Duckett and Swerissen 2016: 4); on our 50/50 split of the market, the non-obese 'third party' would pay $250m in SSB tax revenue, over twice the 'third party' savings of $106m that the SSB tax would bring. Thus, the Duckett and Swerissen tax fails their main goal, which is to reduce the burden on the non-obese.[10]

However, we suggest that Duckett and Swerissen have over-estimated the SSB tax revenue of $500m by a factor of two: it should be $260m, of which maybe $130m would be borne by the non-obese.[11] This arithmetical correction does not change the qualitative conclusion that the non-obese would suffer a net financial loss from the implementation of the SSB tax. (The obese would incur the payment of their share of the SSB tax revenue, plus the loss of consumer surplus.)

Duckett and Swerissen cannot logically respond that, in welfare economics, the SSB tax payment by the non-obese is merely a transfer, and so is not a cost to the economy—this line of argument is not available to them because they themselves have included, as 'third party costs', the income tax revenue that is forgone because of obesity, and counted this transfer as a cost of obesity that is borne by the non-obese (Duckett and Swerissen 2016: 52, 54).[12] Nor would it be tolerable to claim that the only relevant 'third party' costs are those caused by the condition of obesity itself, and not by efforts to reduce obesity: that would open the door to the acceptance of any number of ludicrous policy proposals.[13]

So, on their own criterion and their own data, the SSB tax proposed by Duckett and Swerissen would increase 'third party' costs, rather than reduce them. To justify the tax, on economic grounds or on Duckett and Swerissen grounds, we need to add in some other net benefits.

4. 'Third party' costs and market failures

Before proceeding, we show that Duckett and Swerissen's conception of 'third party' costs leads to a paradox. Consider a society in which everyone is obese. On Duckett and Swerissen conception, because there would then be no 'third party', there would be no 'third party' cost and therefore, no market failure. But this is nonsensical: yet, it is the logical inference from the Duckett and Swerissen conception of 'third party' costs.[14]

For an efficiency analysis based on the concept 'external costs', from a policy point of view it is not necessary to identify precisely upon whom the costs are incident, but only to show that they are external to the individual generating them; for a distributional analysis, like Duckett and Swerissen's, it is necessary to be precise about incidence.

When an obese individual consumes more SSB, he or she generates costs that are not fully met *by that individual*. In the standard terminology of economics, these are 'external' costs; they are costs that have not been brought to bear on the individual taking the action. Unless these costs are 'internalised' to the individual, the individual will consume more than is economically efficient: the market 'fails' to produce the ideal level of consumption. (Again, Freebairn 2010 offers a clear exposition.) But note that these external costs *fall on all other individuals collectively, including on other obese people.* The 'third party' or external costs of an individual fall, in some fashion, on all other individuals, whether or not those others themselves also generate similar external costs. It may be that the other obese people bear less than a *per capita* portion of the external costs caused by this particular obese individual—but clearly it cannot be assumed, as Duckett and Swerissen have done, that *none of the external costs generated by an obese person fall on other obese persons, but only on the non-obese*. Third party' may be a useful legal term to characterise what is going on, but Duckett and Swerissen misapplied it in this instance: an obese person, Doe, purchases a SSB from a seller, Roe, for purposes of consumption: to this transaction everyone else, and not merely the non-obese, should be regarded as the 'third party'.

5. Boost to post-tax income as economic benefit

Thus far, we have seen that the fiscal burden of the SSB tax would dominate any 'third party' gains from reduced costs of obesity, so that the tax fails on Duckett and Swerissen's own criteria: the SSB tax would not reduce 'third party costs', as they define the 'third party'. More importantly, the SSB tax fails the usual economic test: aggregate benefits would about equal the aggregate costs; and both are tiny and uncertain, when considered in economic policy space. However, we need to be assured that omitted items would not, if included, swing the balance in favour of the tax.

Duckett and Swerissen recognised that there are 'personal' benefits to the obese from their proposed tax, but they did not include them in their vestigial and casual policy evaluation, on the grounds that the 'third party' benefits are sufficient to justify the tax. The only personal benefit to what they offer data relates to employment income, net of income tax, which would accrue to formerly obese unemployed or underemployed, now more engaged in the workforce or more productive, because of the tax reduces obesity. After showing what this could yield, by way of additional personal income, we argue that the personal benefit is less than the post-tax income, because of the personal costs of employment; and then we raise serious questions about the whole procedure (relating to the effects of a two per cent reduction in the prevalence of obesity).

Duckett and Swerissen (2016: 54) postulated that, after the imposition of the tax on sugar-sweetened beverage, the person (formerly obese and unemployed) would now earn $51,602 and pay $11,088 in income tax plus the Medicare levy, leaving post-tax earnings of $40,514. (They also discuss small effects on company taxation, which we set aside.)[15]

To arrive at the aggregate effects, we need an estimate of the employment stimulus directly attributable to the SSB tax. The report says that obesity reduces employment by 232,000 (Duckett and Swerissen 2016: 54); and that their proposed tax would lead to about a two per cent reduction in 'the prevalence of obesity' (Duckett and Swerissen 2016: 4). Provisionally, therefore, in the absence of any guidance by Duckett and Swerissen, we will assume that the SSB tax would increase employment by two per cent of 232,000, or 4,640. Then, the aggregate increase in the post-tax earnings of the obese would be about $190m.

However, an adjustment is needed. Although Duckett and Swerissen mentioned the private costs of obesity to the obese person and family, they do not consider the private costs of employment, the chief of which is the disutility of work or loss of leisure. This neglect can lead to a considerable overstatement of the benefit to the employees (and to national economic welfare or efficiency, concepts that Duckett and Swerissen eschew).

The newly employed obese people would collectively earn an estimated $190m after tax, which is more than the obese would pay in SSB tax (again, assuming a 50/50 split in consumption of SSB). However, a sizeable deduction has to be made from those post-tax incomes, in order to arrive at an estimate of private benefits: generally, there is a disutility to work.

If, for example, the relevant labour supply were of unitary elasticity, the money value of the disutility of work would be equal to half the net-of-tax income earned, thus halving the aggregate benefit to the obese, to around $95m.

Significantly, if we add this $95m to the economic assessment, if converts a net cost of $6m into a net benefit of about $90m, still negligible, but on the black side of the ledger. However, we now argue that the basis of our calculation of the employment stimulus, of 4640 full-time equivalents earning $190m, is far too generous.

6. Two per cent of what

To move from the estimate of the income tax and post-tax incomes generated by the employment of one formerly obese person, to the aggregate benefit, requires an estimate of the number of additional employees that would occur because of the policy. We could not find any such in Duckett and Swerissen. However, as already noted, they did report that 232,000 full-time-equivalent employees would join the workforce *if obesity were completely abolished*; and they concluded that the SSB tax would reduce the 'prevalence' of obesity by two per cent (Duckett and Swerissen 2016: 54, 4. We take the phrase 'obesity prevalence' to mean the incidence of BMI > 30.)

Duckett and Swerissen draw upon a report from PwC that discusses the costs and benefits of a whole suite of measures that, together, would reduce the predicted *increase* in Australian obesity to 2025 by 3.4 per cent (PwC 2015: vii),

whereas Duckett and Swerissen claim that a single policy measure, a 20 per cent tax on the sugar content of SSB, which they claim contributes a mere 10 per cent to obesity, would reduce its incidence by two per cent. PwC and Duckett and Swerissen cannot both be right.

PwC provided tables for each intervention, showing the projected effects on numbers in each obesity Class, so their estimates of effects of interventions were 'bottom up'. PwC (2015: 37) cited an ACE report (Vos *et al.* 2010: 3), also using 'bottom up', that claimed a 10 per cent tax on unhealthy food would cut the present value of future health costs of obesity by $3.5b: this is from a tax on healthy foods generally, and not a tax only on the SSBs. The ACE report set out to 'measure realistic health gains, rather than hypothetical health gains assessed *against perfect health'* (Vos *et al.* 2010: 21, emphasis added); this is good research methodology.

Unfortunately, Duckett and Swerissen did not explain how they arrived at two per cent but it must have been 'top down'. We assume that it was as follows: the tax reduces the quantity of SSB sold by approximately 20 per cent; but SSB contribute only 10 per cent to the 'obesity problem' (Duckett and Swerissen 2016: 22): 10 per cent of 20 per cent is two per cent.[16]

It is tempting, therefore, to do as we did in the previous section, and assume that the SSB tax, in isolation, would stimulate employment by two per cent of that which would occur if obesity were abolished; that is, by two per cent of 232,000, which is 4,640. However, this requires a very strong and implausible assumption, one that Duckett and Swerissen nowhere stated but which we think is implied in their reasoning and tone; but also one (we argue) that would unjustifiably inflate the estimates of the aggregate effects of the tax, via the employment route. The questionable assumption is that the SSB tax would have two per cent of the employment (and other) effects that would have been produced, *were obesity abolished completely*.

By their own account, Duckett and Swerissen expect the tax to have a very small effect on obesity—they quote studies suggesting 0.41kg weight reduction (Duckett and Swerissen 2106: 39). For a 116kg person, 1.7m tall, such a weight loss would reduce her BMI from Class III to II, but surely this would not have an effect on her labour-force participation equal to two per cent of the effect of her ceasing to be obese: that feat would require her weight to fall from 115 to 86kg. More generally, most of the reduction in the incidence of obesity would occur through weight loss in Class I (30 ≤ MBI < 35), sufficient to be classed as non-obese (BMI < 30). Therefore, if the SSB tax is to bring an extra 4,000 into employment, arguably most would come from Class I, which contains over 3,250,000 adults, or 65 per cent of the obese.[17] These are people with a condition that is unlikely to have had major effects on their labour force participation; thus, we would expect a second-order effect on their labour force participation from a tax-induced minor reduction in weight.

The only satisfactory way to assess the benefits of interventions in these circumstances is to follow PwC (2015) and others, and assess the effects at a

finer-grained level than the 'prevalence' of obesity. This is what was done in Veerman, Sacks and Martin (2016: 8), where is it argued that a modest reduction in SSB intake, due to a 20 per cent *ad val.* SSB tax, would translate into the saving of around 170,000 disability-adjusted life years (DALY) for the 2010 Australian adult population. By our calculation, these 170,000 DALY would add at most 0.02 per cent to that population's life years.[18] However, the effect on obesity itself would be very much larger: 'The tax could result in a decline in the prevalence of obesity of about 2.7% (0.7 percentage point) among men, and 1.2% (0.3 percentage point) among women, compared to business as usual' (Veerman, Sacks and Martin 2016: 4. The simple average of 2.7 and 1.2 is around the two per cent fall in 'prevalence' of obesity that Duckett and Swerissen used.)

Thus, the proportional decline in the prevalence of obesity would be at least an order of magnitude larger than proportional effect on life expectancy and, presumably, similarly for workforce participation and earning power. (Veerman, Sacks and Martin did not discuss employment effects.)

7. Other omitted items

Duckett and Swerissen note four items of cost that they omit, due to difficulties of estimation and uncertainty: State and Commonwealth Government spending on obesity campaigns and interventions; higher private health insurance premiums due to higher healthcare costs from obesity; the costs of childhood obesity; and the deadweight loss from the additional tax revenue that needs to be generated to pay for the extra public expenditure on health and welfare (which they in fact estimated at $750m and which we took into account, above).

However, probably the most important item omitted by Duckett and Swerissen was not a cost, but the private benefits of the improvement in health. One of the reports that they drew upon is Veerman, Sacks and Martin (2016), which, as mentioned, estimated the improvement in the health of the obese in terms of DALY, from the same SSB tax. In our footnote, we report a crude attempt at putting a monetary value of this health improvement, and show that it would exceed the loss of SSB consumer surplus for any value of a DALY greater than $25,000; and that the health gain would then vastly outweigh the savings in health costs upon which Duckett and Swerissen focussed so much attention.

8. Net fiscal balance as indicator

Duckett and Swerissen make much about their estimated $500m in SSB tax revenue, almost as though, in itself, it indicates that this is a good tax. In particular, they stated that

> The revenue raised by the new tax could go to promoting healthier eating, preventing obesity, reducing the budget deficit or a variety of other purposes. (3).

And they devoted two pages to the use of the revenue, as input into a political campaign (43, 44).

However, the proposed tax offends two principles of a good revenue system:
- Nuisance taxes should be avoided, unless there are good reasons for the tax, other than revenue.
- A broad-based GST with single rate is preferred to a set of retail sales taxes at differentiated rates.

As to the first: we have shown that, on Duckett and Swerissen's data estimates, the proposed tax, considered as a means of internalising an externality, does not pass muster. That leaves the tax to be justified as a revenue source, *per se*. On the calculations presented earlier, the average excess burden of the tax would be around 20 per cent: excess burden of $58m, revenue of $260m. (Recall that we believe that Duckett and Swerissen have greatly over-estimated the revenue at $500m). On the usual rule of thumb, the marginal excess burden may well be 40 per cent, or twice the average. When estimating the full costs of obesity, including public spending, Duckett and Swerissen (2016: 55) used a marginal excess burden of 25¢ per dollar of additional revenue: on that standard, the SSB tax would be an unattractive revenue source. Moreover, it would involve another exception to the general rule of a uniform GST, or require the re-introduction of taxes at the wholesale level.
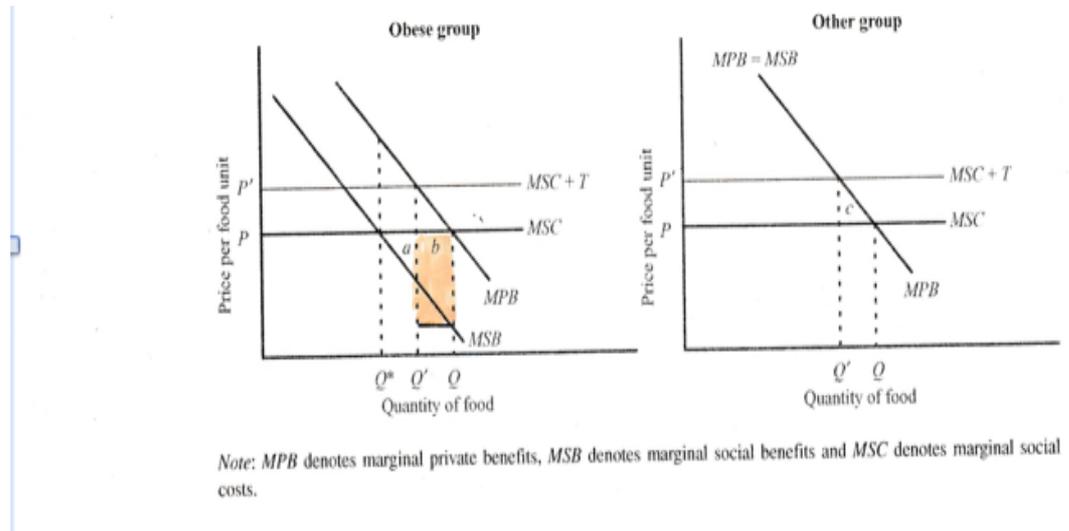
In the Appendices, we discuss stringent theoretical circumstance in which an increase in tax revenue or improvement in fiscal balance is a reliable indicator of the net economic benefit of the policy; and contrast them with the situation here under discussion.

9. Conclusion

1. On the evidence provided by Duckett and Swerissen, the proposed 40¢ tax per 100g of the sugar content of sugar-sweetened beverages would almost certainly add to the financial burden on the non-obese 'third party', and so fails Duckett and Swerissen's own, flawed distributional test.

2. On normal criteria of tax design and the same evidence, it would be a nuisance tax that cannot be justified on economic grounds:
    a. The gross benefit and costs are small and about equal.
    b. It would not have an especially low average excess burden.

3. The evidence provided by Duckett and Swerissen carries a great deal of uncertainty and imprecision, and is marred by arithmetical and conceptual errors that, when corrected, generally damage their case.

4. The SSB tax would likely have a trivial effect on the employment of obese persons.

5. Duckett and Swerissen omitted consideration of the value of the private benefits of improved health, *per se*.

6. The standard economic concept of 'external costs' of a health condition is to be preferred to the notion of 'third party' costs, when the 'third party' is defined as all those without the condition in question, which here is obesity.

7. The distributional analysis used by Duckett and Swerissen is not an appropriate basis for examining the economic efficiency of the tax that they propose.

Figure 1. Heterogeneous Consumer Groups

Note: *MPB* denotes marginal private benefits, *MSB* denotes marginal social benefits and *MSC* denotes marginal social costs.

Source: Freebairn (2010: 61. Area *b* has been coloured and given a lower border, for easier interpretation.)

Table 1. Data used

	Item (units)	Data	Source*	Comments
1	Value of sales of SSB ($m)	1620	35	
2	Average price of SSB ($/L)	2.00	35	
3	Volume of sales of SSB (ML)	810	*3 = 1 ÷ 2*	
4	Elasticity of demand for SSB	− 0.9	35	
5	Proposed tax ($/100g sugar in SSB)	0.40	4	
6	Average sugar content (g/L)	93	35	
7	Tax per litre ($/L)	0.40	3: 'Increase the price of a two-litre soft drink by about 80 cents'	*7 = 5 × 6*, rounded up to nearest 10¢
8	*Ad val.* equivalent tax (decimal fraction)	0.20	*8 = 7 ÷ 2*	
9	Estimated SSB tax revenue ($m)	500	4	Or $265m: see note 11.
10	Obese adult Australians (per cent of adult population)	28	4, 52	Class I: 18.4%; Class II: 6.3%; Class III: 3.2%
11	SSB contribution to obesity problem (decimal fraction)	0.10	22	
12	Reduction in obesity 'prevalence' due to SSB tax (decimal fraction)	0.02	4	
13	External costs of obesity, less transfers ($m)	2,600	4, 52	Only external, real resource costs (health)
14	External costs avoided by SSB tax ($m)	52	*14 = 12 × 13*	
15	'Forgone' tax from obesity ($m)	2.3	52, 54	Is $2.6m: see text

* Duckett and Swerissen (2016) unless otherwise noted.

Appendix 1. Fiscal dividend as welfare improvement

The public economics literature does spell out the theoretical circumstances in which the increase (or decrease) in tax revenue is itself an accurate indicator of the change in aggregate economic welfare or efficiency. In particular, Kaplow (2008: 127-135) discussed a tax package involving a change in commodity taxation, combined with a change in the income tax schedule, with the latter such that it restores income taxpayers (the universe of people) to their pre-change levels of utility. This conceptual framework ensures that there is no income effect on the choice of labour supply (at the expense of leisure). However, there would be a substitution effect, because of the change in commodity tax rates. In these circumstances, any rise in tax receipts would be an exact indicator of an improvement in economic efficiency: the fiscal surplus generated by the policy change could be distributed in such a way as to satisfy the Pareto criterion. *So long as the income effect on behaviour is neutralised* in the policy change, an improvement in the public budget indicates the feasibility of an improvement in economic efficiency or welfare: an improvement in the public budget can be used instead to improve some or all taxpayers' economic welfare, without any diminution in the welfare of others.

Although a different methodology is adopted in computable general equilibrium (CGE) models, on reflection it can be seen to support the corollary of the Kaplow result: after the general equilibrium effects have been taken into account, the improvement in economic efficiency (or in all taxpayers' economic welfare; or that of some, without any diminution in the welfare of others) can be used instead to improve the public budget, while leaving taxpayers indifferent between the situations pre- and post-change.

In CGE models of policy changes, economic efficiency or welfare is estimated directly, typically using a 'closure' of the model that assumes that lump sum taxes or transfers are used to keep the public budget balance invariant. For convenience, consider the case in which the model estimated that the policy change would generate a welfare improvement after a lump sum tax is used to preserve the budget balance. Clearly, it is feasible for a larger lump sum tax to be found that would leave the public budget in surplus, compared with the pre-change situation, while preserving the pre-change utility level and thus neutralising the income effect.[19] This brings the CGE result into line with Kaplow's: an improvement in the public budget can be taken as and taken for an improvement in economic efficiency or welfare, and *vice versa*, *so long as the income effect on behaviour is neutralised or could feasibly be neutralised*.

In the Kaplow framework, because the income effect of the policy change is neutralised, an improvement in the public budget of the kind that allows (or represents) an improvement in welfare, does not involve a reduction in leisure or an increase in labour supplied, whereas in the CGE framework, an improvement in welfare—which could have been used to improve the public budget—may very well involve an increase in labour supply. However, the disutility of additional labour is fully taken into account in the CGE model. This does not always happen in partial assessments of policy changes.

14

Appendix 2. Fitting Duckett and Swerissen into the Kaplow framework

Whereas the Kaplow experiment involved mere changes in taxes, the Duckett and Swerissen proposal involved what is effectively a change in productivity potential of the obese person. When we modify the Duckett and Swerissen approach to fit the Kaplow framework, we can show that the rise in tax receipts is not a reliable indicator of the change in economic welfare.

Say that a magic wand made an obese person less obese and more productive. The magic wand has a kind of substitution effect—the person can now turn time and effort into earned income or turn it at a more favourable rate than previously—we will illustrate the first case, in which initially the person had no capacity to work and so, before the SSB tax, had the endowment at point A, with a pension and other public payments equal to OX_1, and leisure of $0L_1$. After the magic wand, the person's budget constraint shifts from L_1AX_1, to BG, and she chooses to consume at C, where her income consists in the reduced public payment, L_1B, plus earnings of X_2X_3 after income tax; leisure falls to $0L_3$. Now, in spirit of Kaplow's thought experiment, impose a lump sum tax equal to FG, such that, along the hypothetical budget line HF, the welfare-maximum choice is at point D, where the level of utility is equal to that at the initial endowment point, A. (Not shown is the indifference curve that contains A and is tangent to HF at D.) Thus, FG is an exact measure of the money value of the increase in utility that the magic wand has produced, evaluated at the transformation rate of leisure into post-tax income.

We will now show that the change in earned income, after income tax, may be an under-estimate or an over-estimate of the increase in utility, that is, can be larger or smaller than FG. Without specifying functional forms, we cannot say whether the gain in utility is equal, greater or less than the improvement in the public budget.

Before the magic wand, the person chooses point A; afterwards, point C which, *as constructed*, involves more work and an income of $0X_3$, of which X_2X_3 is earnings after income tax. However, there is nothing to ensure that an interior solution like C exists: the person may wish to stay at A, and earn nothing; if so, then there is a degenerative case—there is no change in the person's welfare or in earned income. More generally, if there is an interior solution at C, then post-tax earned income, X_2X_3, must be larger than the withdrawal of pension, BA; however, nothing ensures that the rise in earnings would be greater than the money value of the gain in utility, FG. The size of net effect on the public budget is equal to the savings in welfare payment, BA, plus whatever tax was deducted to arrive at post-tax income, X_2X_3: this may be greater or less than the rise in utility, FG.

Figure 2: Increases in productivity, income and welfare
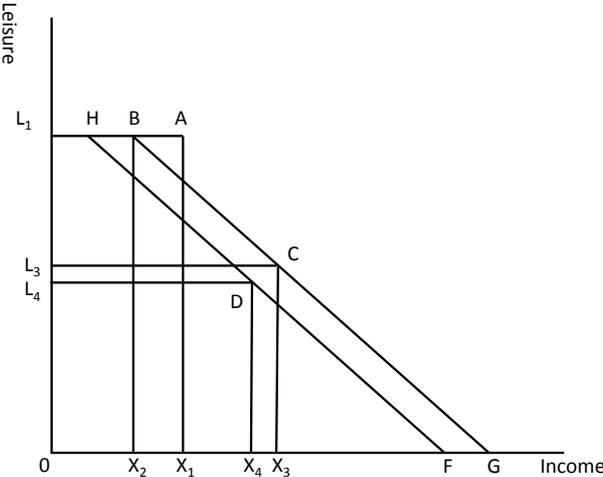
References

Duckett, S. and Swerissen, H. 2016, *A sugary drinks tax. Recovering the community costs of obesity*, Report No. 2016-15, November, Grattan Institute, Melbourne, <https://grattan.edu.au/wp-content/uploads/2016/11/880-A-sugary-drinks-tax.pdf>

Ergas, H. 2016, 'Sugar coating hard truths about obesity tax,' *The Australian*, November 28, <http://www.theaustralian.com.au/opinion/columnists/henry-ergas/sugar-coating-hard-truths-about-obesity-tax/news-story/75de31a16f3611c7bae86e0761d6a2c4>

Gardiner, A., 2016, 'Implications of a Sugar Tax in New Zealand: Incidence and Effectiveness,' New Zealand Treasury, *Working Paper* 16/09 <http://www.treasury.govt.nz/publications/research-policy/wp/2016/16-09/twp16-09.pdf>

Kaplow, L. 2011, *The Theory of Taxation and Public Economics*, Princeton University Press, Princeton N.J.

PwC (2015), *Weighing the cost of obesity: A case for action* <http://www.pwc.com.au/pdf/weighing-the-cost-of-obesity-final.pdf>

Veerman, J. L., Sacks, G., Antonopoulos, N., and Martin, J. 2016, 'The Impact of a Tax on Sugar-Sweetened Beverages on Health and Health Care Costs: A Modelling Study,' *PLoS ONE*, 11. 4.

Vos, T., Carter R., Barendregt, J., Mihalopoulos, C., Veerman, J.L., Magnus, A., Cobac, L., Bertram, M.Y., Wallace, A.L., ACE-Prevention Team 2010, *Assessing Cost-Effectiveness in Prevention (ACE Prevention),* Final Report, University of Queensland, Brisbane and Deakin University, Melbourne <https://www.slideshare.net/rcofinof/ace-prevention-finalreport>

---

[*] Visiting Professor, School of Economics, The University of Adelaide. The author has no financial interest in the material of this paper.

[1] Note 83 reads as follows: 'An SSB tax will still provide a social benefit if the reduction in costs caused by overconsumption is greater than the loss of welfare from non-obese people consuming the taxed products, see Cnossen (2010).'

[2] The rectangle marked *b* has been shaded and delineated at its base.

[3] External costs can include non-material cost (like the nuisance of a noisy neighbour, or the grief at the death of a friend): for an economist, these are just as 'real' as the resource costs of a stay in hospital.

[4] Ergas (2016) criticised Duckett and Swerissen for including the 25 cents deadweight loss along with the dollar of tax revenue spent on the obese, or of income tax revenue forgone due to obesity. Duckett and Swerissen claimed that they were conducting an assessment of the economic efficiency of the SSB tax: for that purpose, including both the amount of transfer payments and their DWL would indeed have been an error. Nonetheless, it is not an error in a distributional analysis, which is what in fact they offered but which they treated as though it were an efficiency test, which it is not. However, as noted, having stated that the

deadweight loss should be added to the quantum of obesity-related expenditure and forgone tax, they estimated it but did not use the estimate.

[5] The formula for demand elasticity, η, gives $\Delta Q = \eta Qt$, where t is the *ad val.* rate of tax. Thus, $\Delta Q = 0.9 \times 810ML \times 0.2 = 146ML$.

[6] This is the sum of health costs, hospital care and pharmaceuticals (Duckett and Swerissen 2016: 52).

[7] A calculation would show that, if the obese consumed all SSB, the net gain from the tax would be a trivial $8m.

[8] Duckett and Swerissen list irrationality and ignorance as reasons for overconsumption, but do not claim that the tax would diminish them, but only that the tax would offset some of their damaging effects.

[9] The other criterion seems to be that the SSB tax must be good because it itself produces public revenue: see section 8 below.

[10] We have followed Duckett and Swerissen and assumed all 'third party' costs fall on the 72 per cent who are not obese: assigning some of these costs to the obese would reinforce the conclusion that the tax would harm the non-obese more than it would help them. Also, arithmetic shows that only if the 72 per cent of adult Australians who are not obese consume less than 2.2 per cent of SSB would they enjoy net savings in 'third party' costs. We have ignored the consumption by children, which could hardly change the qualitative conclusions, if taken into account.

[11] According the Duckett and Swerissen (2016: 33), the evidence is that the tax will be fully passed through to the consumers. If so, then the tax revenue would be 40 cents per litre sold; the sales volume would shrink from 810 to 664 million litres (that is, by about 18 per cent), so the revenue would be around $0.4 \times 664m = $260m, not $500m. (If account were taken of any inelasticity in supply, the estimate of tax revenue would not change much.)

[12] To be consistent, one should treat the forgone income tax of $2.2bn and the SSB tax paid by the non-obese in an identical fashion: either as transfers (and worry about excess burdens) or as 'third party' costs.

[13] For example, funding a full-time personal trainer as well as a dietician for every obese person would no doubt reduce the total of the 'third party' costs, as they are conceived by Duckett and Swerissen, but at huge costs to the taxpayer.

[14] Duckett and Swerissen's dangerous conception of third party costs should have had quantitative consequences for their estimates. In particular, whatever use is made of the forgone income tax, it will probably not be all directed at the 72 per cent of adults who are non-obese, so it would be more reasonable to categorise only 72 per cent of the forgone income tax as a third party cost, than to categorise 100 per cent of it. Similarly, for the other of Duckett and Swerissen's 'third party' costs, like the additions to public health spending—this is financed through the public budget, and not through a special sub-account set up to receive tax payments from the non-obese.

[15] Incidentally, the forgone income tax, included in the total of 'third party' costs, is given as $2.3m, but should be $2.6bn = 232,000 \times $11,088.

[16] The 20 per cent fall in consumption is thus: *ad val.* equivalent of the tax is 20 per cent; the demand elasticity is – 0.9, so that consumption would fall about 18 per cent, rounded up to 20.

[17] Twenty-three per cent of the adult population who are obese are in Class II (35 to 39.99) and 12 per cent in Class III (40+).

[18] For the 20 to 24 years cohort, about two-thirds would be in life days (4.9 extra days for a male, and 2.7 days for a female), and one-third in improved quality of life (Veerman, Sacks and Martin 2016: 4). The life expectancy of a 20 year old is around 25,000 days: 4.9/25,000 = 0.0002.

[19] Most commonly, CGE models assume a single household that owns all the productive factors and supplies all the labour. However, the parallel between the two frameworks, Kaplow's and CGE modellers', would still apply.