Sugar Consumption in Australia

A statistical update

4 October 2012

By:

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Executive Summary

This paper clarifies some issues surrounding sugar consumption statistics in Australia. In the past few years, claims that sugar consumption is rising rapidly have been argued vigorously from opposing viewpoints. One major problem for anyone looking closely at the issue – from policy makers, industry, health professionals and others – is that the Australian Bureau of Statistics (ABS) ceased publishing their "Apparent Consumption of Foodstuffs" data in 1998/99. This publication was the best government-collated data on foodstuffs consumption. Now, regulatory issues regarding food consumption are often debated and decided without independent ABS data to rely on.

In the absence of ABS collating such data, the Australian Sugar Refiners and CANEGROWERS[1] have commissioned an independent analysis by Green Pool Commodity Specialists (Green Pool) to publish an updated set of statistics on sugar consumption in Australia using ABS methodology, and to make a detailed assessment of the underlying data and trends. The main findings of this study are as follows:

- The long-term trend for sugar consumption per capita in Australia is down. This report uses an updated ABS data series (original 1938-1998, updated 1999-2011), using the ABS methodology (the "ABS extended series").
- Sugar consumption per capita has fallen from 57 kg/capita in 1951 to around 42 kg/capita in 2011. There is some variability around the trend line, for which causal factors are suggested.
- The ABS extended data series is a more robust and accurate series than any current alternative. In particular, data derived from Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)[2] is shown to be seriously deficient, and ABARES' own analysts admit it is a poor measure of consumption.
- Regression analysis[3] shows that a downtrend line explains 52.66% of the variability in the ABS (extended) dataset from 1970 to 2011– an adequate result for a time series over 41 years. Conversely, an uptrend line explains less than 1% of the variability in the ABARES data series, due to the enormous volatility in the dataset.
- The ABS extended series captures several important factors that ABARES' data does not. The ABS series measures sales by domestic refiners to all direct users and manufacturers in Australia. It also incorporates sugar imports into Australia, which ABARES does not. Additionally, the ABS extended series measures the sugar content of imports and exports of manufactured goods including blended food ingredients. Blends represent an important export product, and a factor substantially distorting alternative measures of Australian sugar consumption. ABARES did not intend its total production less exports data to be used to measure consumption – and in fact published data similar to the ABS series in a 1991 paper.
- Exports from Australia of food preparations rose sharply in the 1990s, peaking in 1996-2002, but have since fallen. A sizeable portion of these exports were to Japan to "bust" high Japanese tariffs on imported sugar (and consequently avoid high Japanese sugar prices). The strong Australian currency has now reduced blend exports from Australia.

[1] CANEGROWERS is the peak body for Australian sugarcane growers
[2] ABARES is a research organisation within the Australian Government Department of Agriculture, Fisheries and Forestry
[3] Regression Analysis is used to fit a line showing trend to a dataset, and quote a standard statistic – the R-squared or R^2 – to show how well that trend line "fits" the data. R-squared values range from 0 to 1 (or 0 to 100%).

- Whereas Australia has been a net exporter of sugar in sugar-containing products (peaking at close to 150,000 mt of sugar in products in 2002), it is now a net importer of sugar in sugar-containing products (of 22,000 mt of sugar in products in 2011). Australian food manufacturers have lost competitiveness against overseas producers, and some manufactures have moved off-shore.
- Claims that there is widespread proliferation of fructose in foods (in place of sucrose) could not be verified. While no compositional data for fructose in food imports was readily available from ABS, no production of fructose (powdered or as high fructose corn syrup) in Australia could be verified. This is very different to the USA, where fructose is a mainstream food ingredient. ABS import data shows only 3,000 tonnes per annum (or 0.13 kg/capita) of fructose imported into Australia in 2011 for all purposes, and at least some of this is re-exported in food preparation blends to Japan.

The longer-term down trend and the shorter-term 10.34% reduction in adjusted per capita sugar consumption in Australia, from a peak of 46.26 kg in 2004 to 41.97 kg in 2011, may be due to a number of factors. The most important are likely to be increasing global sugar prices and dietary changes, which may have contributed to increased use of intense sweeteners (Equal, Sucralose etc.) and reduced usage of sugar in both the household and in manufactured goods. Further examination of these issues in more detailed dietary studies may help to clarify such trends.

The fact that no Australian government agency currently collates and publishes apparent consumption data for products including sugar is regrettable. It leaves a void for industry, which will always be open to accusations of attempting to portray data trends to its advantage. Green Pool's report is an independent expert report, and it is intended that this report be published in an appropriate economics or health economics journal and be subject to normal publication scrutiny.

3 October 2012

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About Green Pool:

Green Pool Commodity Specialists is an independent and privately owned analytical firm based in Brisbane, Australia. Green Pool's analytical focus is on the global soft commodity (including sugar) and biofuels markets, with a central focus on agriculture, climate, and market dynamics. Green Pool produces independent forecasts of annual and quarterly statistical balances in its focus commodities. Green Pool's team has a broad experience in soft commodities, grains and biofuels markets.

Green Pool's client base includes international commodity trading firms, producers, processors, fund investors and banks. Its independent ownership means it can express an objective view of markets or market factors, built on high ethical standards and leading market knowledge. The firm's consultancy work is well respected, with recent assignments for an international private equity fund, a large global food processor and several multinational producers and processors.

1. Introduction

Objective - The objective of this paper is to update a data series on sugar consumption, previously published by ABS until 1998/99, and to determine whether it is a viable and verifiable data series which accurately reflects sugar consumption. A more detailed set of objectives is to:

- provide verifiable statistical information on sugar consumption – particularly in light of a widely held perception that sugar consumption is increasing (perhaps rapidly) in the Australian diet;
- update information for commercial participants to verify the size of the Australian sugar market and per capita consumption, given increasing population in Australia; and
- investigate import and export trends, in both sugar and sugar-containing products.

The focus of this analysis is on sugar – defined as sucrose – and this analysis does not investigate in detail other sugars or alternative (high intensity) sweeteners. The production and import of fructose, however is investigated, since many arguments have been made about the rising consumption of fructose in the USA (in fact currently falling) and elsewhere.

This study has been commissioned by the three major sugar refining companies in Australia – Bundaberg Sugar, Manildra Harwood Sugars and Sugar Australia – as well as CANEGROWERS. Domestic production, sales and stocks data was provided confidentially to Green Pool by refining companies and other processors and milling companies which sell or utilise small tonnages of sugar domestically but are not captured under the refiners' sales data. Detailed data was obtained from the Australian Bureau of Statistics (ABS) covering the import and export of sugar-containing products, and the import and export of various categories of sugar and other non-sucrose nutritive sweeteners into Australia. Additional data was also sourced from ABARES.

Methodology – the methodology used in the study is detailed in Appendix 1.

2. Calculating Sugar Consumption

From the 1930s to 1998/99, ABS consistently prepared apparent consumption data for a wide range of foodstuffs – meat, eggs, vegetables, oils, grains, sugar etc. The ABS methodology was to collect stocks, production, and import and export data, and to derive a consumption figure from this data (Diagram 1 here). Importantly, ABS included import/export data for both the food itself and manufactured goods containing that food.

Thus, for important components of foodstuffs – flour, oils, sugar etc. – ABS supplemented the direct domestic consumption of the food with an estimate of the import/export balance for that food (Diagram 2). ABS then published its "Apparent Consumption Data", using roughly the same methodology each year. It ceased doing so in 1998/99. In doing so, it left a void for a wide range of users of such data – from policy makers, health professionals, industry and others.

Government reporting – confusing, contradictory

It is fair to say that in absence of the ABS continuing to report sugar consumption statistics, reporting of such statistics in Australia is confused, conflicting and flawed. A recent example demonstrates this issue. In the past few months, the International Sugar Organisation (ISO), of which Australia is a member, has reported 2011/12 production statistics for Australia which are close to 14% incorrect (3.1 mln mt vs. actual of 3.60 mln mt). This data is passed by ISO to the global Food and Agriculture Organisation (FAO), whose statistics on food issues are well respected globally. ISO receives its data from Australia's Dept. of Agriculture, Fisheries and Forestry (DAFF), part of BRS (formerly Bureau of Rural Sciences). DAFF collects data from industry. That issue is still "in abeyance" while DAFF sorts out data-sourcing issues that led to this very substantial error (Australia effectively "lost" 500,000 tonnes of raw sugar from 2011/12).

Assuming that this data glitch is a "one off" and will be rectified, it is worth examining in more detail the various responsibilities for sugar statistics in government. As per Diagram 3 here, at least three agencies have reporting responsibility for sugar statistics. ABARES publishes trade data - production and export statistics. BRS generates production and export figures for international bodies such as ISO and FAO, but claims not to calculate consumption or stocks figures (yet ISO reports them). BRS (DAFF) points to the accepted international methodology (Diagram 1), but claims that since ABS stopped calculating the "Apparent Consumption" series, BRS has not reported anything independently, because it does not have the resources to collect such domestic consumption data.

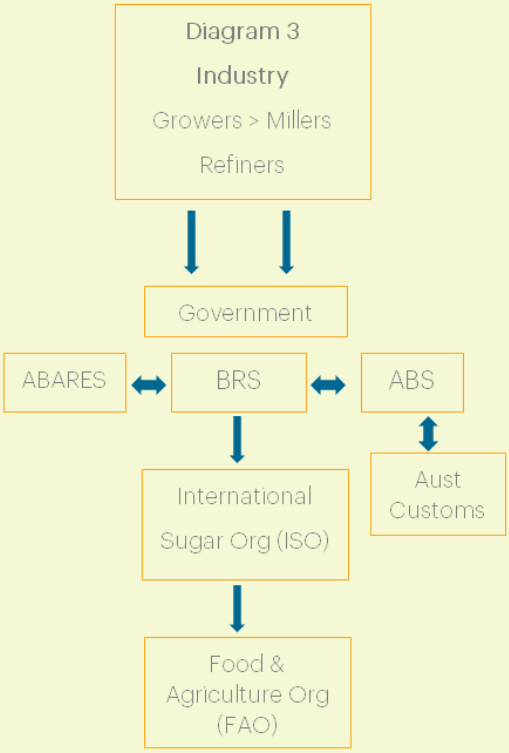
ABS meanwhile collates import and export statistics which are fed to it by Australian Customs. ABS reports imports and exports of refined

Diagram 1.
Calculating Domestic Consumption

Opening Stock
+
Production
+
Imports
-
Consumption
-
Exports
=
End Stock

Diagram 2.
Methodology for Sugar

Calculate *Consumption* as above
+
Sugar Equivalent of Imported Foods
-
Sugar Equivalent of Exported Foods
=
Apparent Consumption
÷
Population
=
Apparent Consumption Per Capita



sugar on a monthly basis, but only reports raw sugar exports on a quarterly basis and with a six-month delay (i.e. it can delay their publication by up to nine months).

Integrating Customs Import/Export data

In writing this report, Green Pool liaised with the ABS to obtain a solid understanding of the methodology used to calculate its sugar consumption, import and export statistics. ABS provided advice on all relevant categories of imports and exports, and assisted in updating categories in light of continually changing Australian Customs data codes. ABS also provided its detailed sugar content assumptions for food import and export categories.

ABS data aggregates many products, even within categories. However, there are some checks and balances inherent in the process. For example, the same sugar content factor is used in export and import calculations, unless there is a verifiable reason. As an example, Australian Customs data for sugar confectionery (Table 1) saw imports in 2008 of 32,811,830 kg and exports of 10,999,243 kg. ABS assessed the sugar content of this category at 75%, a figure which would have accurately reflected sugar confectionery content in the 1990s, but probably overstates current sugar content (given the increase in sugar-free confectionery ranges in the interim, and current ingredient data for sugar confectionery). Thus the sugar content of sugar confectionery in 2008 was assessed at imports of 24,609 tonnes, and exports of 8,249 tonnes (netting out at 16,360 tonnes sugar imported, and thus counted against domestic sugar consumption). This methodology was utilised for 173 categories of imported products and 120 categories of exported products.

3. ABS data in detail

The data set for ABS (as previously noted) stretches from 1938/39 to 1998/99, with annual data at least from the late 1940's to 1998/99. That ABS data has been used as the basis of this analysis. It was then extended using the same data sources and methodology as the ABS (as described above) to 2011. To clarify, the ABS data for apparent consumption of sugar (sucrose) is the addition of its two categories:

As Refined Sugar + In Manufactured Foods

Excluded from the analysis are the further sweetener categories of honey, syrups and glucose (Diagram 4). However, any sugar (sucrose) syrup manufactured and sold domestically from 1999 to 2011 has been included with sugar production and sales data, given syrups are made during the regular sugar manufacturing process. The longer-term ABS extended data series for sugar consumption from 1938 to 2011 is shown in the first graph opposite. The shorter-term series, from 1970 to 2011, compares total sugar consumption and per capita (per person per year) consumption in the last graph.

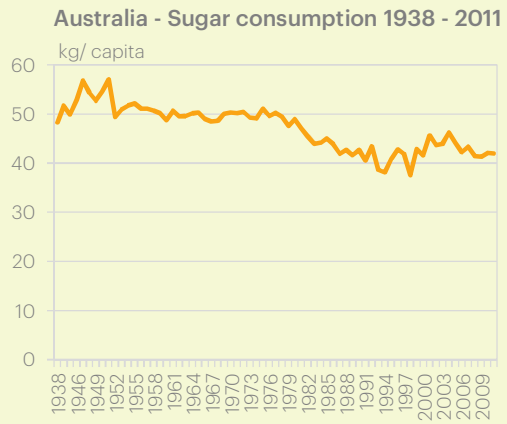
Table 1.
Australia - Import/Export of Confectionery 2008

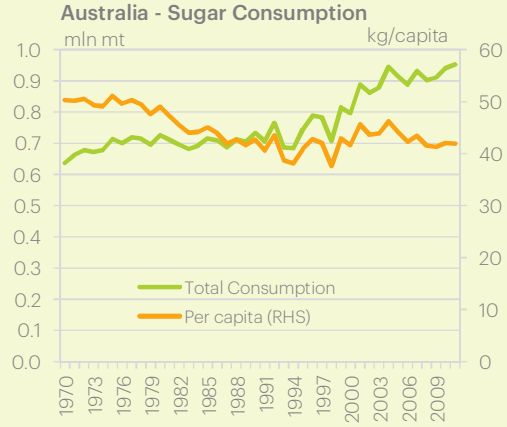
Customs Code	Activity	Sugar %	Product (kg)	Sugar (t)
1704900044*	Import	75%	32,811,830	24,609
1704900044*	Export	75%	10,999,243	8,249

*Sugar Confectionery (incl. white chocolate), not containing cocoa (excl. chewing gum)

Diagram 4.
Defining Australian Per Capita Consumption of Sugar

- What it includes:
  - Home Usage
  - Manufactured Foods
  - Restaurant Usage
  - Take Aways
  - Imported Foods and drinks
  - Imported Food Ingredients
  - Imported Sugar
- What it excludes:
  - Other Sweeteners (fructose, dextrose, etc.)
  - Exported Foods
  - Exported Food Ingredients
  - Exported Sugar





From 1970 to 2011, total sugar supplied to the Australian market (including sugar imports, and adjusted for imports/exports of sugar-containing products) rose from 637,000 mt to 953,000 mt. In that same period, Australia's population rose from 12.663 million to 22.777 million people. On a per capita basis, sugar consumption fell from 50.3 kg/head in 1970 to 41.97 kg/head in 2011. In this period, it fell as low as 37.6 kg/head in 1998 and revived to 46.26 kg/head in 2004.

ABS measured total and per capita sugar consumption from the 1930s. It reported consumption at between 48.3 and 57.0 kg/capita from 1938 through to 1970.

4. Updating ABS Data 1999 - 2011

From the sales data provided by individual Australian refiners and other sources (detailed in Appendix 1 – Methodology), the size of the domestic sugar market (including sugar imports but excluding products containing sugar) was determined for the period 1999 to 2011. Domestic sales including imports peaked in 2004 at 1.02 mln mt (orange line 1st graph here) and then fell steadily to a 2008 low of 920,500 mt. Annual sales have recovered slightly from 2009, and in 2011 were approximately 930,300 mt. Since 2008, imports of raw and refined sugar into Australia have increased substantially (2nd graph shows food grade sugar imports).

Raw sugar imports were excluded from this analysis. These occasional imports are used for refining purposes and then sold by refiners, so are captured already in refined sugar sales data. Unadjusted domestic consumption (3rd graph) was calculated as follows:

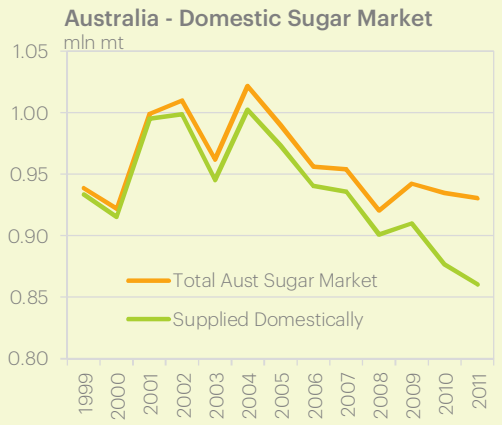
Refinery sales (domestic) + other sales + food grade sugar imports.

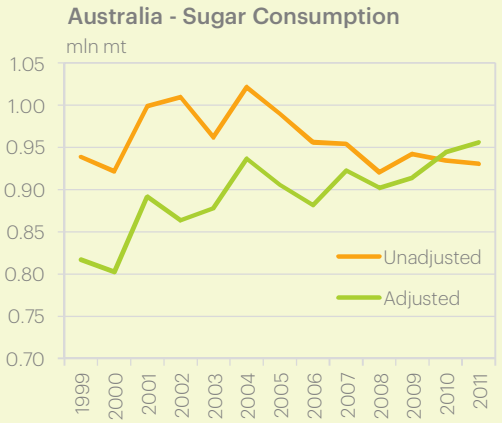
While Australia is an exporter of 150-250,000 tonnes per annum of refined sugar, sizeable imports of refined sugar into Australia are a relatively new phenomenon. This is at least partly attributable to higher costs of domestic freight following changes to the coastal shipping laws in Australia in the past 3 to 4 years. The increased imports have mainly been refined sugar from Thailand and Malaysia into South and Western Australia.

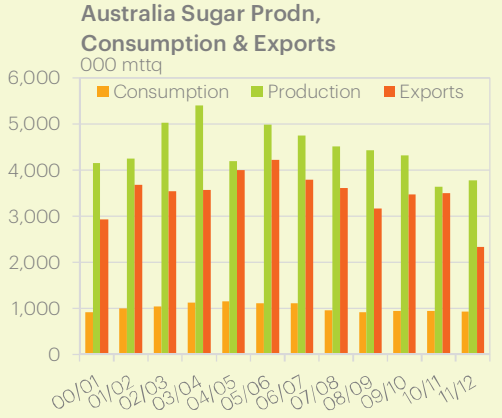
It should be noted that the ABARES data excludes any imports of refined sugar – which in 2011 would amount to a 70,000 tonne error in the calculations (around 3.2 kg/capita).

5. Sugar Import & Exports

Sugar Import/Export balance – Australia remains an efficient exporter of raw sugar to global markets (with most exported into Asia) of some 3 to 4 million tonnes over the past decade (last graph this page). It is also an efficient exporter of refined sugar into







regional markets. Despite the increase in refined sugar imports into Australia since 2009, Australia is still a sizeable net exporter of refined sugar within the Asian/Pacific region. As with manufactured goods, much depends on the competition and the value of the Australian dollar.

6. Population

Population is important to the sugar consumption equation only because it is the factor used to divide total domestic usage to show per capita consumption. ABS population data clearly shows that Australia's population growth is maintaining a steady rate, both numerically and as a percentage of the prior year's population. Growth rates were 1.4% in 2005, but crept up to 2.2% in 2008. Due to a reduction in net overseas migration, the growth rate for 2011 was back down to 1.4%, the equivalent of an additional 330,000 people per annum. Total population was estimated at the end of 2011 to be in excess of 22.7 million people (1st graph). Since 2000, this equates to an increase of 18% or almost 3.5 million people.

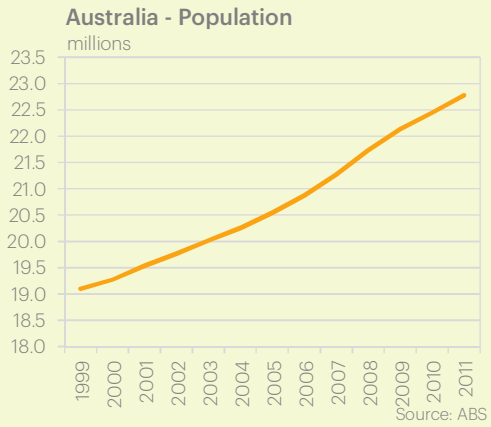
As the 2nd graph here shows, while "adjusted" sugar sales (green line) have been growing, so has population (orange line).

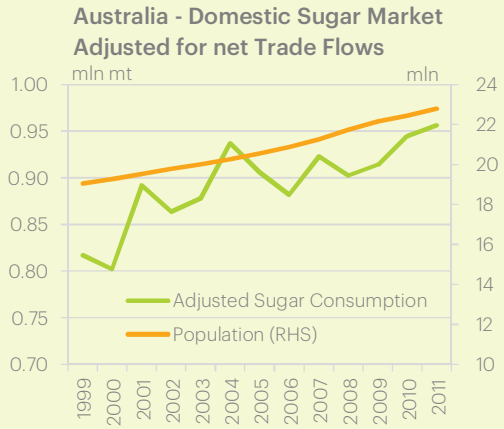
7. Sugar-Containing Products

In the period from 1999 to 2009, Australia was a net exporter of sugar-containing products. The period from late in the 1990s to around early-2006 showed strong growth in exports of sugar-containing products from Australia (partly as a result of the Japanese blends trade which will be discussed later). By 2010, Australia had turned from net exporter to net importer of sugar-containing products.

Sugar-Containing Products swing to net imports – it is no particular revelation to those in the food business, but Australia is importing much more of its food partly due to the strong currency, and the lack of competitiveness of its manufacturers. Australia has been a competitive exporter of food into Asia over time, but that competitiveness has been eroded, particularly in the last five years.

Australia's exports of sugar in products averaged around 185,000 mt from 2000 to 2006 (green bars, 3rd graph), driven largely by the export of dairy products containing sugar (mostly blends). Japan was a sizeable driver of that trade – for sugar blended with other food ingredients (mostly to reduce the tariff levied on the sugar content of the blends imports). Total sugar exports in products from Australia fell by almost 19% in 2007 and not only failed to recover but declined further, with exports over the 2007-11 period averaging only 145,000 mt of sugar content. Full import/export statistics by category are shown in Appendix 3.





The very same conditions which discouraged exports have encouraged imports of products containing sugar. These have grown steadily over the past decade, reaching almost 160,000 mt in sugar equivalent in 2011 (orange bars, 3rd graph previous page). The balance between exports and imports of sugar containing products (in kg of sugar per capita) is shown in this 1st graph. Importantly, Australia's domestic market usage was inflated by 3 to 8 kg/capita in the late 1990s through to 2006 by net exports of sugar in products.

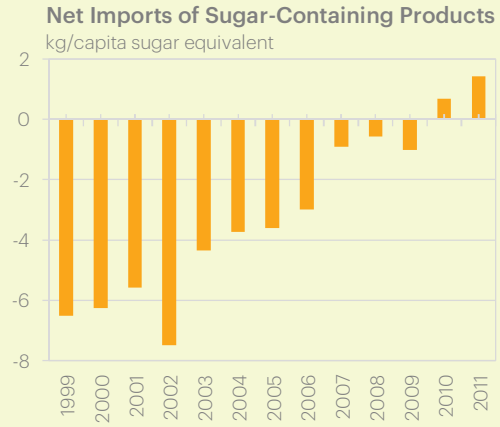
Import/Export By category – Strong growth across all categories of imported products (2nd graph here) suggests that the trend is being driven as much by macro-economic factors, such as an appreciating exchange rate, as by product-specific factors such as supplier competition.

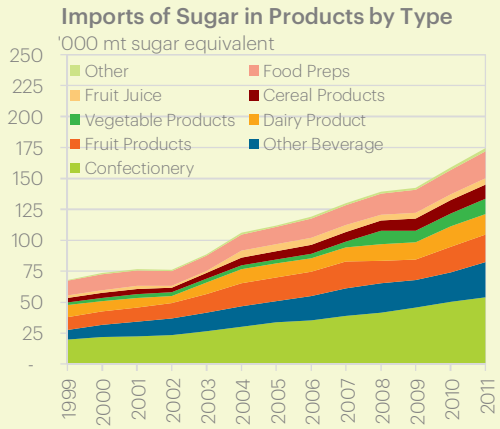
This 2nd graph of increased sugar imported in foodstuffs, combined with the 3rd graph of a reduction in sugar exported in foodstuffs completes the picture for Australian sugar refiners. It shows reduced sales not only due to dietary shifts for consumers, but also reduced sales to Australian food manufacturers who are finding the competition in manufacturers incredibly stiff. Some are moving food production offshore, and importing products into Australia. Blends manufacturers for the Japanese market are losing business to Singapore and Thailand whose governments give incentives to exporters (Singapore) or set the domestic price of sugar below the international price (Thailand) and are, in any case, closer to Japan for freighting the end product.

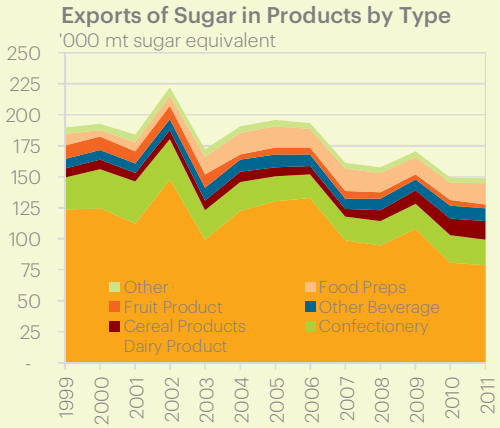
8. Data – ABS (extended) vs. ABARES

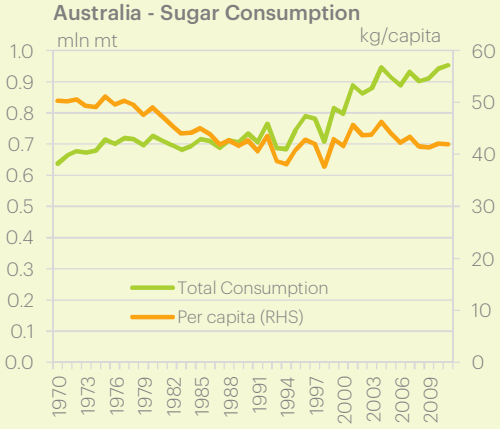
Having examined the ABS series and having extended it from 1999 to 2011, it is worth examining an alternative dataset – that derived from ABARES data for sugar production and export from Australia. It has been claimed that the ABARES dataset is a superior measure of Australian sugar consumption. The ABARES dataset though has the following deficiencies as a measure of consumption:

1. The data is driven by Australian raw sugar production and exports – and therefore overstates refined sugar usage by 8.7 per cent. Why? Because in the refining process, raw sugar loses around 8.7% of its weight, as water and various impurities are discarded as steam and molasses. By comparison, sugar in ABS' series is based on refined sugar total usage.
2. ABARES' data is exceptionally volatile, a factor driven by production, stocks and export quantity variability. The measure takes no account of Australia's raw sugar stock variation year-on-year let alone variation in refined sugar stocks.
3. It understates consumption by disregarding imports of refined sugar into Australia









4. It disregards imports and exports of sugar-containing products for Australia.

These are substantial enough flaws to render the ABARES series unworkable for the purpose of calculating sugar consumption.

The ABS series is shown again in the last graph previous page– both in total consumption or usage terms, and per capita. In the 1st graph here, a linear trend line is fitted to the per capita usage line. It is clear in this graph, and evidenced by the regression equation: y= - 0.2166x + 49.181 that the trend is down (see Section 9 Regression Analysis). This takes into account the sharper rate of decline in the 1980's and early 1990s, and the bounce back up in consumption in the late 1990s to mid-2000s (more on that later).

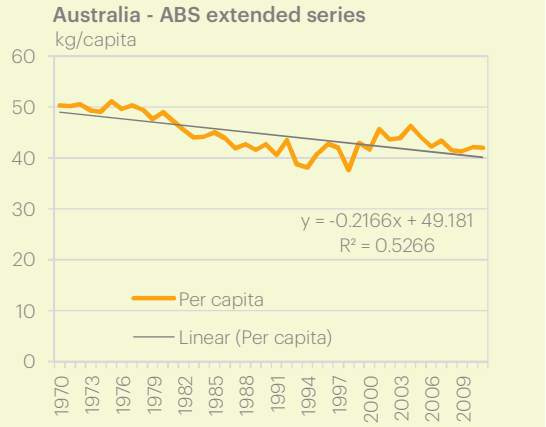
Comparison ABS with ABARES Series: So, does the ABARES series provide a better dataset? In one simple word, "No". There are several reasons for this, but firstly, consider the two datasets displayed on the one graph (2nd graph). The volatility in the ABARES derived series (green line) is enormous. Who can credibly explain swings of 20 to 30 kg per head across an entire population of 17 to 22 million people year after year? The data series ranges from 35 kg/head to 70 kg/head, and traverses that range multiple times. Could Australia's best measure of per capita sugar consumption really register a reading of 47.9 kg/head in 1998, 68.9 in 1999, 55.8 in 2000 and 68.8 in 2001 before plummeting to 49.2 in 2003 and 47.6 in 2004?

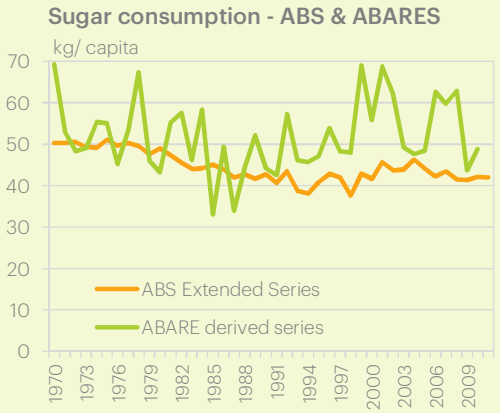
ABARES themselves not only discouraged their production and export data being used to proxy sugar consumption, but they did not use it. An ABARES paper from 1991 (extract in Appendix 2) provided data for total Australian sugar consumption. It is shown here on the 3rd graph as the green line – matching closely the orange line which is the ABS data series inclusive of honey, glucose and syrups for the same period. The ABS series excluding honey, glucose and syrups is also shown (blue line). The real story is in the green and red lines – ABARES' own published series for the period (green) vs. the ABARES series, derived as production less exports (red). The saw-toothed red line inexplicably falls from 0.914 mln tonnes in 1984 to 0.526 mln mt in 1985, back to 0.797 mln mt in 1986 – and so on.

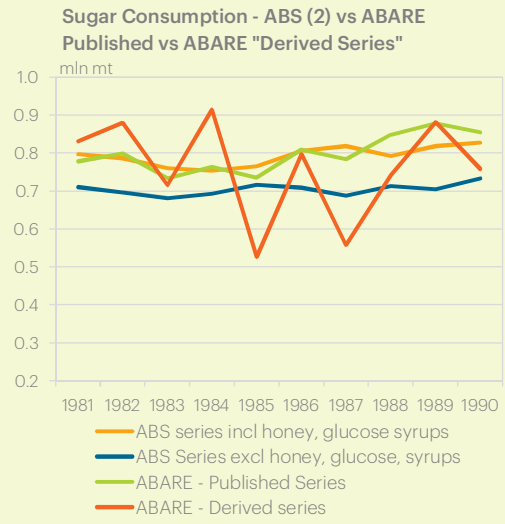
9. Regression Analysis

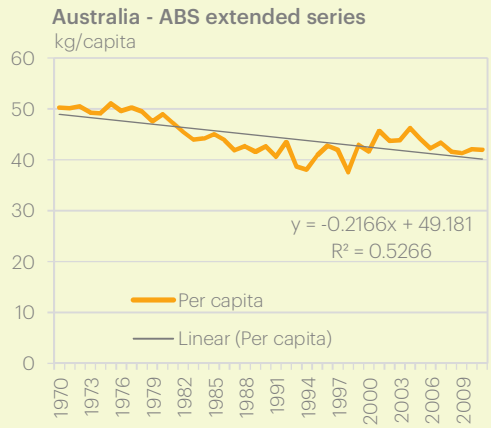
A simple regression analysis was performed on both the ABS and ABARES derived data series, to determine whether trend lines captured the variability in the datasets. Regression results are expressed as an R^2 value, ranging between 0 and 1, which shows the "goodness of fit" of a trend line to the underlying dataset.

First, the linear trend line fitted to the ABS data from 1970 to 2011 revealed an equation *y= -0.2166x + 49.181* with an R^2 value of 0.5266 (last graph). Whilst the R^2 value would desirably be higher, long-term time series are unlikely to show very high R^2 values. In light of the



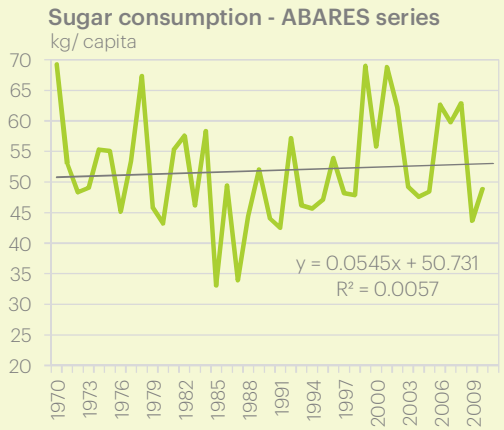






changes in economic fortunes and dietary patterns detailed below, a trend line which explains 52.66% of the variability in the ABS dataset is reasonable.

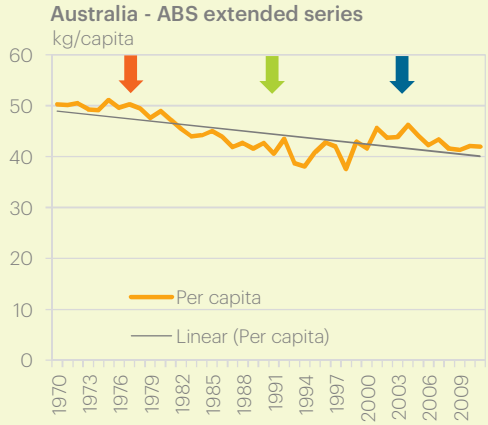
By contrast, a linear trend line fitted to the ABARES derived data series showed a mild uptrend, with the equation *y= 0.0545x + 50.731*, and an R^2 value of 0.0057 (1st graph). The low R^2 value (less than 1%) shows the trend line has almost nil explanatory power for the underlying dataset, reflecting the high volatility of the data. From an analytical perspective, the ABARES derived series adds no value in explaining trends in Australian domestic sugar consumption.



10. Do blends explain trends?

The variability of the ABS data series around the downtrend line invites the question: what are the underlying causes of the variability? These variations are shown in this 2nd graph:

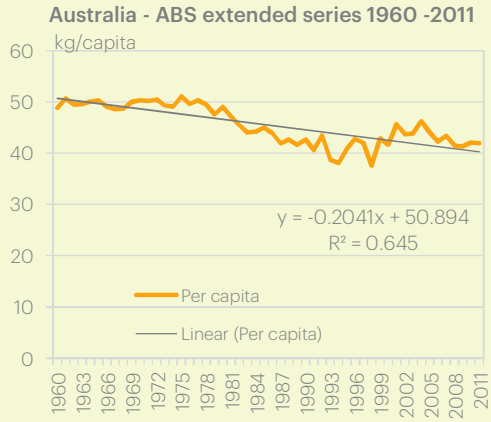
1. Above trend – red arrow – 1970-82.
2. Below trend – green arrow – 1982-98
3. Above trend – blue arrow – 1999-2011



With regard to no. 1, consumption in this period 1970-82 may be above the 1970-2011 trend line, but it is broadly in keeping with the 1938 to 1969 data of 48 to 54.3 kg/capita consumption figure. An extended series back to 1960 (3rd graph) shows per capita sugar consumption relatively stagnant around 50 kg/capita in the 1960's, which increases the R^2 value of the trend line for the series 1960 to 2011 to 0.645. Note that all prior analysis uses a dataset 1970 to 2011 because this was the only data period for which the ABARES series was also available.

Between 1980 and 1998, sugar consumption per capita falls by 23 per cent – from 49 kg/capita to around 37.6 kg/capita. That low point came at the time of the Asian Financial Crisis in 1998, although that may just be a coincidence in timing rather than a direct cause.

The increase shown in the 2nd graph by the blue arrow for 1999 to around 2006 is still a puzzle. Per capita consumption rose to 46.26 kg/capita at its short term peak in 2004, before falling again to around 42 kg/capita between 2008 and 2011. This variability raises the question – did Australian consumption per capita rise because of dietary change (which appears to have since reversed), or is there something else going on?



Perhaps it's a combination of the two, with the "Japanese blend trade" being the "something else". In essence, a new trade blossomed for innovative Australian exporters in the 1990s whereby Japanese food manufacturers saw a way to beat high tariffs on sugar imports by importing sugar blended with other food ingredients (a classic "tariff-busting" exercise). These blended ingredients are not normal food ingredients (such as cake mix you buy at the

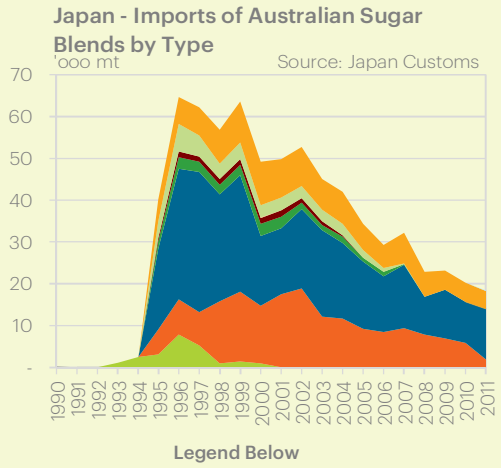
supermarket) – they are specific food ingredient blends that feed into a food manufacturing process at lower cost than if the manufacturer was to buy the separate ingredients locally in Japan. They can be as high as 89% sugar (with the balance being other food ingredients such as cocoa, sorbitol, salt, or milk powder).

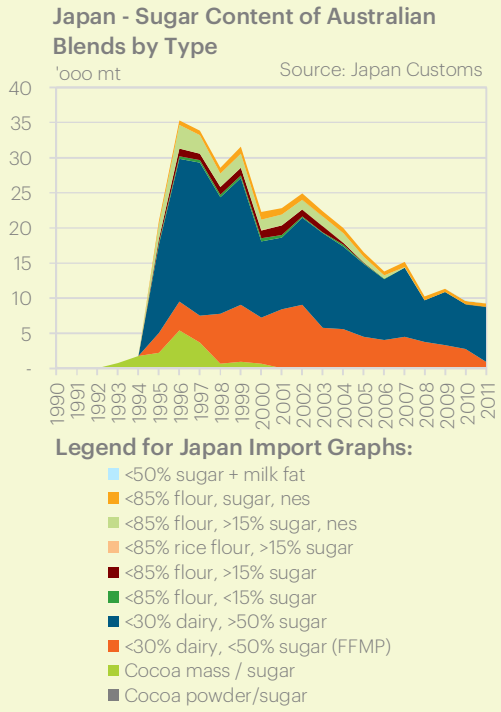
Unfortunately, while Japanese Customs provides very specific (but possibly understated) data on this trade, Australian Customs and ABS do not. The two area graphs opposite were compiled from Japan Customs data, showing that at its peak in the late 1990s, around 65,000 mt of these blends was being shipped from Australia to Japan, containing around 34,000 mt of refined sugar. The largest export was of sugar/powdered milk blend, usually specified by Japanese importers at 68-69% sugar, 28-29% skim or full cream milk, 2-3% dextrose or other ingredient, and sometimes coffee or other flavouring (depending on the product to be made from the blended ingredients). The average sugar content of all these blends (for which accurate specifications were obtained) is shown in the 3rd graph here. Using the Japan Customs data, export blends average 45-50% sugar over the period 1991 to 2011 (with early years higher because they were for very high sugar content blends with cocoa).

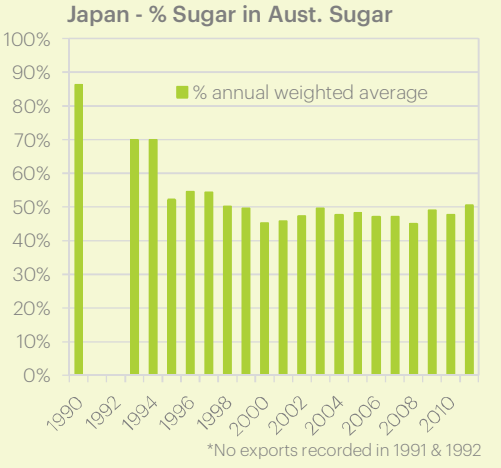
What is the relevance of this export (and import) trade to Australia's sugar content statistics?

1. The export statistics from Australia and import statistics from Japan do not marry up. Australian Customs data does not give sufficient detail to discern what was exported, but Japan's import data is too low to account for the exports provided by just one large Australian exporter, in some years.
2. ABS used a factor of only 10% sugar content to account for food preparations, whereas the real content (as above) is around 45-50% for exports. ABS also used the same factor on imports, but unfortunately cannot provide exact detail on the composition of those imports going back 20 years.
3. Modified ABS sugar content data for imports of food preparations to 25% sugar and for exports to 35% sugar were used in this study, since food preparations coming into Australia are more likely to be prepared cake mixes and the like, whereas the exports average 45-50% sugar content. This adjustment is conservative - there is a risk that this adjustment overstates the average sugar content of imports, and understates that of exports, but without better information that may be a "reasonable" approximation.

Thus, these analytical endeavours have been stymied somewhat by a lack of detail available from Australian Customs and ABS. In the meantime, the analysis here partially supports a view that blended food ingredients contribute to the resurgence in "Australian" sugar







consumption from the late 1990s to around 2006. That remains an analytical hunch rather than an analytical outcome at this stage.

11. The Role of Fructose

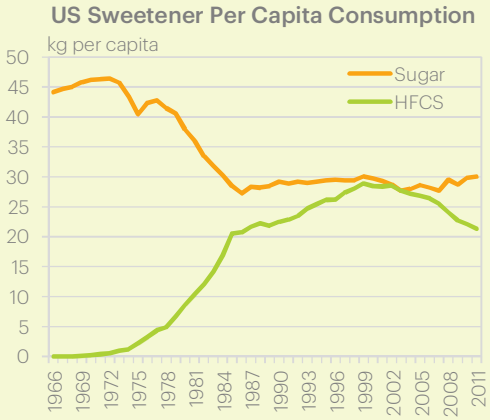
Fructose is often mentioned in the public debate on diet as being a "new health problem", and its usage "increasing rapidly in the average diet". Sugar (sucrose) and fructose are also often confused, and critics often use the words sugar and fructose interchangeably. Quite a lot of the recent diet literature has come from, and been influenced by, US dietary trends, raising issues as to the relevance for any discussion of sweetener usage in Australia.

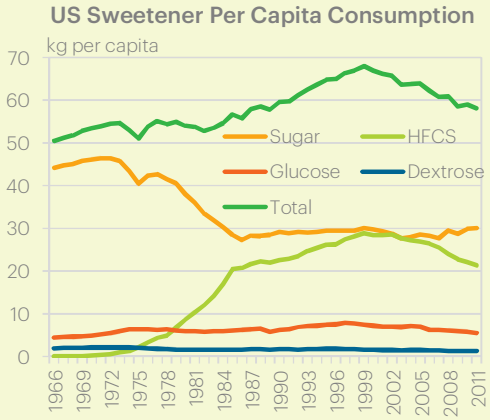
Australia is different to the US. In the US, consumption of sugar (sucrose) and fructose has been for some years about 50/50 in the average US diet (fructose consumption has fallen in the past 4-5 years). For example, in 2001 in the US, sugar accounted for around 29.3 kg/capita, while fructose (both High Fructose Corn Syrup or HFCS, and crystalline fructose) accounted for 28.4 kg/capita for a total of 57.7 kg/capita (1st graph). The US produces fructose from corn, and uses the liquid form – HFCS – almost exclusively in its soft drink industry instead of sugar. The 2nd graph opposite shows that total sweetener consumption in the US is currently just under 60 kg/capita, with sugar and fructose supplemented by glucose and some dextrose.

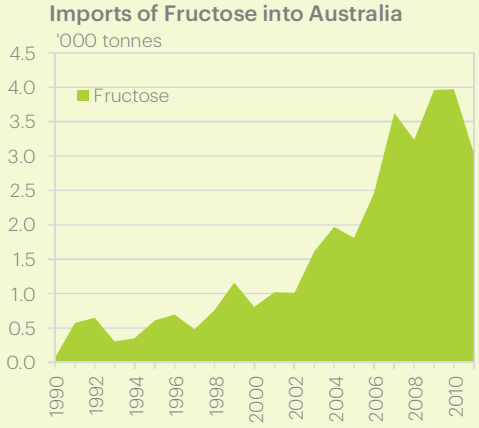
Fructose is not produced in Australia (at least no current producers were found – there was one producer for a short time in the 1990s, but they no longer produce fructose). If it is, as claimed, in most products on the supermarket shelf, then logically, any food producer in Australia would have to import it. ABS data records only around 3,000 tonnes of crystalline fructose (and negligible HFCS) currently being imported into Australia (see 3rd graph) – or around 0.13 kg per person per year. Of course, there is fructose in some imported products as a food ingredient, but anecdotally, it seems a lot less than the significant quantities implied by critics. There is also at least one blender for the Japanese market who imports some of that crystalline fructose from Japan and exports it back to Japan again in blended food ingredients.

12. Other issues

Sugar Consumption and Waste: Some contributors to the debate on sugar consumption have made assertions regarding the validity of broad consumption figures which do not account for waste in food production and usage. This paper is not intended to address health/nutrition issues – others are much better qualified. However, it is noted that the USDA routinely publishes sugar consumption figures including an allowance for waste. As shown in Appendix 4, USDA allows for 11% loss from retail/ institutional level to consumer







levels and for 34% loss at a consumer level (categorised as other loss – uneaten food, spoilage etc.).

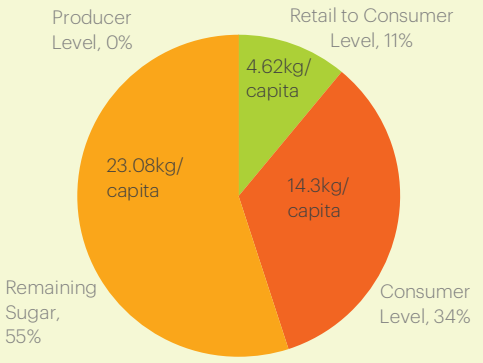
Such losses are consistent with product spoilage across a range of food at retail levels and it is noted that USDA allows for zero loss at any point from primary level of production to the retail level, which seems generous. Sugar is, after all, an ingredient in a range of products that have very short shelf life such as bakery, cakes, biscuits, ice cream etc.

These USDA figures imply that while at a production level 42 kg/capita is available to Australian consumers (1st graph), some 4.62 kg/capita would be wasted at retail to consumer level, and 14.3 kg/capita would be wasted at consumer level. That implies a "true" sugar (sucrose) consumption figure in Australia of 23.1 kg/capita.

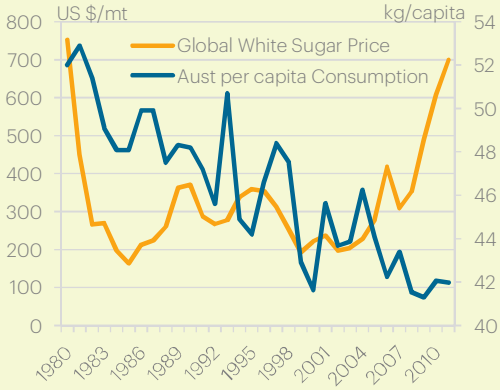
Sugar Prices: Given the inconclusive nature of the blends discussion, various other issues were investigated for possible impacts on sugar consumption. The 2nd graph here shows global white sugar prices over the past 30 years vs. Australian per capita total consumption. There isn't much correlation – one might make the observation that global sugar prices were extremely low in the period 1999-2006, the period when consumption moved back to 46 kg/capita, and then prices rose sharply from 2007-11, which may have impacted on sugar consumption in Australia. This would though run counter to prevailing wisdom that sugar consumption is relatively inelastic (it is suspected that in a tough manufacturing environment such Australia, there is some substitution of sugar and intense sweeteners for one another depending on price). However, this is not an issue to bet the proverbial sheep station on – the evidence isn't strong.

Weather impacts: As weather is often thought to impact sugar consumption (in ice cream, soft drinks etc.), particularly in hot summers, this was also investigated. This final graph shows per capita sugar consumption vs. temperature variation for Sydney and Melbourne – the two largest cities in Australia. Whilst one could pick out a few possible trends – the 1980s and early 1990s when sugar consumption was falling were cooler than average, whereas 2000-2006 were somewhat hotter than average, this possible causal relationship appears to come unstuck in the period 2006-2011. In this period, consistently higher than average temperatures coincided with falling sugar consumption.

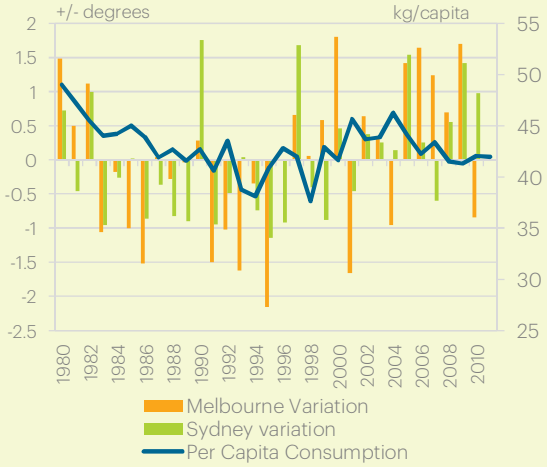
2011 Australian Sugar Consumption Incorporating USDA Wastage Factors



Per capita usage vs Global Sugar Av Price



Per capita sugar vs Deviation fm av summer max temp - Sydney & Melbourne



13. Conclusions

A downtrend in Australian sugar consumption from the 1970s to 2011 was observed, and an R^2 value of 0.5266 for a trend line fitted to this ABS dataset gives validation of this observation. A trend line fitted to an alternative dataset derived from ABARES' production minus export data yields an R^2 value of only 0.0057. With such a low regression statistic, the ABARES dataset was deemed to provide no valid explanation of trends in Australian sugar consumption for the same period.

Detailed analysis was performed on imports and exports of sugar-containing products, which opens the possibility that some sugar consumption which appears to be attributable to Australian consumers is in fact consumed by importers of foods manufactured in Australia (e.g. in Japan). Conclusive data on the "blends trade" to Japan is not readily available, but this may provide additional explanatory detail on the variability of Australian apparent consumption of sugar from 1990 to 2011.

Some of the factors investigated above could be working in combination – a heightened awareness of dietary issues, together with higher sugar prices in the last five years may explain reduced sugar consumption. It is hypothesised that some of the rise in consumption during 1999 to 2006 is due to the blend trade phenomenon. Nonetheless, it is evident that the trend in sugar consumption over the period 1970 to 2011 is downwards, and that the ABS extended series of data is as good an indicator of sugar consumption trends as is currently available. Moreover, it is clear from the above discussion that the ABARES derived series of data, which has been proposed as a strong indicator of sugar consumption trends in Australia is actually a poor indicator, and has no analytical validity.

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Appendix 1 - Methodology

History – ABS used to calculate apparent domestic sugar consumption data from the 1930s, but stopped doing it in 1998/99. Their methodology was to account for all domestic production, deduct any exports, add any imports and then account for any deficit/surplus in sugar containing products. ABS supplied their sugar content factors to Green Pool to facilitate the updating of Australian sugar consumption. The same sugar content factors have been used in this study. Virtually all factors have largely been left as per ABS calculation, since an update of all data would require a large scale study of both the composition of imports of food into Australia and representative food compositional data for imports and exports of all categories - which is no longer collected by ABS. A conservative change was made to both imports and exports under the category "food preparations" given what is known regarding the sugar contents under this category.

Domestic Sugar Sales – Total domestic market calendar year sugar (sucrose) sales data (all types – DC raw, refined, syrups) were provided by individual refiners. These were aggregated, and any liquid sugar syrups converted to sugar equivalent. Other domestic market usages were also checked to the extent possible – and it was found that any volumes being sold domestically, by e.g. other raw sugar milling companies, are generally very small (normally 2% to 3%). To find total domestic sugar sales, all the above domestic sales were added, together with imports of sugar and sugar syrups. Sugar import data was obtained from ABS. Raw and refined (or processed) sugar export data did not need to be considered, since it was excluded from refiners' domestic sales data.

Imports/Exports of Sugar Containing Products – ABS collects data (from Australian Customs) on all imports and exports of food, from which products with sugar content were selected. The main sugar-containing categories are products such as blends (sugar mixed with milk powder etc. for export), confectionery, cordials, soft drinks, cakes, biscuits etc. While individual products may vary in their exact sugar content, ABS had determined sugar content factors across categories, which were broadly correct in 1998-99.

In summary, data was sourced from the following:

Domestic Sales data – refiners, mills supplying other processors and end users.

Imports/Exports of sugar – ABS data, from Australian Customs import/export declarations

Sugar-Containing Products – from ABS, from Australian Customs imports and exports declarations

Sugar Content factors – from ABS 1999

Population – from ABS census data

Appendix 2 ABARES published Domestic Consumption Data:

ABARES submission 91.5 to the Industry Commission, August 1991 "The Australian Sugar Industry in the 1990s". P.18

3 Australian sugar production, disposal and returns

	Sugar production	Domestic consumption	Sugar exports	Unit value of sugar sales	Returns from sugar sales
	kt a	kt a	kt a	$/t	$m
1981-82	3 434	778	2 655	275	945
1982-83	3 535	799	2 737	222	789
1983-84	3 170	734	2 436	259	821
1984-85	3 547	764	2 783	226	801
1985-86	3 378	735	2 643	223	753
1986-87	3 371	809	2 562	276	929
1987-88	3 439	784	2 655	287	988
1988-89	3 678	848	2 830	333	1 227
1989-90	3 797	879	2 918	366	1 388
1990-91	3 514	854	2 660	336	1 190

a Measured in 94 *net titre*.
Sources: Sugar Board (1990a); ABARE.

Appendix 3– Sugar Equivalent of Imported and Exported Foods, Beverages and Food Preparations – 1999 to 2011

IMPORTS OF PRODUCTS - SUGAR EQUIVALENT (mt)													
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Alcoholic Beverage	496	769	825	730	670	884	901	1,004	1,039	1,260	1,337	1,574	1,978
Cereal Products	3,581	4,086	4,337	3,888	4,412	5,835	6,742	7,621	7,847	8,300	9,621	10,635	11,524
Confectionery	19,730	21,752	22,490	23,163	26,606	30,327	33,636	35,302	38,677	41,717	45,881	50,338	53,883
Dairy Product	9,945	8,679	7,546	5,712	9,080	11,421	11,035	10,941	11,247	13,009	14,148	16,703	16,382
Fruit Juice	2,206	1,844	2,680	1,447	1,743	6,138	5,780	5,433	5,673	4,533	4,838	4,848	5,184
Fruit Products	10,069	10,682	11,606	12,324	15,030	18,715	19,153	19,568	21,648	18,182	16,508	20,313	22,117
Other	259	157	188	285	302	282	315	402	449	447	338	485	409
Other Beverage	7,959	9,874	11,784	13,821	15,129	16,355	17,338	19,567	22,645	23,758	21,975	24,000	28,751
Vegetable Products	2,196	2,583	2,934	2,831	3,137	3,130	3,147	3,547	4,729	11,198	9,360	10,540	12,540
Food Preparations	11,462	13,146	12,394	11,756	12,384	12,901	13,934	15,559	16,139	17,044	18,427	19,428	21,729
Grand Total	**67,903**	**73,573**	**76,784**	**75,958**	**88,493**	**105,988**	**111,980**	**118,943**	**130,092**	**139,449**	**142,433**	**158,864**	**174,497**

EXPORTS OF PRODUCTS - SUGAR EQUIVALENT (mt)													
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Alcoholic Beverage	1,856	1,912	1,940	2,264	2,352	1,097	611	932	609	553	628	598	798
Cereal Products	7,578	7,556	6,968	7,308	7,860	7,964	7,345	7,139	6,510	9,047	10,537	13,469	15,078
Confectionery	25,620	31,440	33,791	32,556	23,722	23,155	19,772	18,789	19,155	19,525	20,141	22,058	20,489
Dairy Product	123,682	124,812	112,434	147,702	99,512	122,817	130,525	132,967	98,635	94,648	108,366	80,905	78,653
Fruit Juice	2,198	2,703	3,340	3,551	3,207	3,446	3,483	2,690	3,101	3,220	2,740	2,548	2,419
Fruit Product	11,028	10,549	9,948	10,747	10,940	4,488	5,608	5,890	6,090	5,164	4,020	4,433	3,268
Other	413	409	408	701	477	382	345	475	278	224	235	247	155
Other Beverage	7,284	7,869	7,704	8,994	9,910	9,820	10,262	8,912	8,029	9,081	9,055	10,306	10,503
Vegetable Products	471	560	388	457	510	491	835	773	753	705	953	787	1,004
Food Preparations	9,549	5,173	7,060	8,028	13,870	17,166	17,195	14,855	18,239	15,453	13,945	14,176	16,546
Grand Total	**189,678**	**192,983**	**183,983**	**222,307**	**172,361**	**190,828**	**195,981**	**193,420**	**161,399**	**157,620**	**170,620**	**149,527**	**148,913**

APPENDIX 4 – USDA tables for US sugar consumption, including adjustment for losses at retail and consumer levels.

Table 51 -- Refined cane and beet sugar: estimated number of per capita calories consumed daily, by calendar year 1/

Year	Primary weight (market level) 2/	Loss from primary to retail weight	Weight at retail level	Loss from retail/institutional to consumer level	Weight at consumer level	Loss at consumer level		Per capita consumption, adjusted for loss			Calories per serving (teaspoon)	Serving weight	Calories consumed daily 3/	Servings (teaspoons) consumed daily 4/
						Nonedible share	Other (uneaten food, spoilage, etc.)							
	lb/yr	percent	lb/yr	percent	lb/yr	percent	percent	lb/yr	oz/day	g/day	number	grams	number	teaspoons
1970	101.8	0.0	101.8	11.0	90.6	0.0	34.0	59.8	2.6	74.3	16.0	4.2	283	17.7
1971	102.1	0.0	102.1	11.0	90.9	0.0	34.0	60.0	2.6	74.5	16.0	4.2	284	17.7
1972	102.3	0.0	102.3	11.0	91.0	0.0	34.0	60.1	2.6	74.7	16.0	4.2	284	17.8
1973	100.8	0.0	100.8	11.0	89.7	0.0	34.0	59.2	2.6	73.6	16.0	4.2	280	17.5
1974	95.7	0.0	95.7	11.0	85.1	0.0	34.0	56.2	2.5	69.8	16.0	4.2	266	16.6
1975	89.2	0.0	89.2	11.0	79.4	0.0	34.0	52.4	2.3	65.1	16.0	4.2	248	15.5
1976	93.4	0.0	93.4	11.0	83.1	0.0	34.0	54.9	2.4	68.2	16.0	4.2	260	16.2
1977	94.2	0.0	94.2	11.0	83.8	0.0	34.0	55.3	2.4	68.8	16.0	4.2	262	16.4
1978	91.4	0.0	91.4	11.0	81.4	0.0	34.0	53.7	2.4	66.7	16.0	4.2	254	15.9
1979	89.3	0.0	89.3	11.0	79.5	0.0	34.0	52.5	2.3	65.2	16.0	4.2	248	15.5
1980	83.6	0.0	83.6	11.0	74.4	0.0	34.0	49.1	2.2	61.0	16.0	4.2	233	14.5
1981	79.4	0.0	79.4	11.0	70.7	0.0	34.0	46.6	2.0	58.0	16.0	4.2	221	13.8
1982	73.7	0.0	73.7	11.0	65.6	0.0	34.0	43.3	1.9	53.8	16.0	4.2	205	12.8
1983	70.3	0.0	70.3	11.0	62.6	0.0	34.0	41.3	1.8	51.3	16.0	4.2	195	12.2
1984	66.7	0.0	66.7	11.0	59.3	0.0	34.0	39.2	1.7	48.7	16.0	4.2	185	11.6
1985	62.7	0.0	62.7	11.0	55.8	0.0	34.0	36.8	1.6	45.8	16.0	4.2	174	10.9
1986	60.0	0.0	60.0	11.0	53.4	0.0	34.0	35.3	1.5	43.8	16.0	4.2	167	10.4
1987	62.4	0.0	62.4	11.0	55.5	0.0	34.0	36.6	1.6	45.5	16.0	4.2	173	10.8
1988	62.1	0.0	62.1	11.0	55.2	0.0	34.0	36.5	1.6	45.3	16.0	4.2	173	10.8
1989	62.8	0.0	62.8	11.0	55.9	0.0	34.0	36.9	1.6	45.8	16.0	4.2	175	10.9
1990	64.4	0.0	64.4	11.0	57.3	0.0	34.0	37.8	1.7	47.0	16.0	4.2	179	11.2
1991	63.6	0.0	63.6	11.0	56.6	0.0	34.0	37.3	1.6	46.4	16.0	4.2	177	11.0
1992	64.2	0.0	64.2	11.0	57.2	0.0	34.0	37.7	1.7	46.9	16.0	4.2	179	11.2
1993	63.8	0.0	63.8	11.0	56.8	0.0	34.0	37.5	1.6	46.6	16.0	4.2	177	11.1
1994	64.4	0.0	64.4	11.0	57.3	0.0	34.0	37.8	1.7	47.0	16.0	4.2	179	11.2
1995	64.9	0.0	64.9	11.0	57.8	0.0	34.0	38.1	1.7	47.4	16.0	4.2	181	11.3
1996	65.2	0.0	65.2	11.0	58.0	0.0	34.0	38.3	1.7	47.6	16.0	4.2	181	11.3
1997	64.9	0.0	64.9	11.0	57.8	0.0	34.0	38.1	1.7	47.4	16.0	4.2	181	11.3
1998	64.9	0.0	64.9	11.0	57.8	0.0	34.0	38.1	1.7	47.4	16.0	4.2	181	11.3
1999	66.3	0.0	66.3	11.0	59.0	0.0	34.0	39.0	1.7	48.4	16.0	4.2	184	11.5
2000	65.6	0.0	65.6	11.0	58.4	0.0	34.0	38.5	1.7	47.9	16.0	4.2	182	11.4
2001	64.5	0.0	64.5	11.0	57.4	0.0	34.0	37.9	1.7	47.1	16.0	4.2	179	11.2
2002	63.3	0.0	63.3	11.0	56.3	0.0	34.0	37.2	1.6	46.2	16.0	4.2	176	11.0
2003	61.0	0.0	61.0	11.0	54.2	0.0	34.0	35.8	1.6	44.5	16.0	4.2	170	10.6
2004	61.6	0.0	61.6	11.0	54.8	0.0	34.0	36.2	1.6	45.0	16.0	4.2	171	10.7
2005	63.1	0.0	63.1	11.0	56.1	0.0	34.0	37.0	1.6	46.0	16.0	4.2	175	11.0
2006	62.1	0.0	62.1	11.0	55.3	0.0	34.0	36.5	1.6	45.3	16.0	4.2	173	10.8
2007	61.1	0.0	61.1	11.0	54.4	0.0	34.0	35.9	1.6	44.6	16.0	4.2	170	10.6
2008	65.0	0.0	65.0	11.0	57.9	0.0	34.0	38.2	1.7	47.5	16.0	4.2	181	11.3
2009	63.4	0.0	63.4	11.0	56.4	0.0	34.0	37.2	1.6	46.2	16.0	4.2	176	11.0
2010	65.7	0.0	65.7	11.0	58.5	0.0	34.0	38.6	1.7	48.0	16.0	4.2	183	11.4
2011	66.2	0.0	66.2	11.0	58.9	0.0	34.0	38.9	1.7	48.3	16.0	4.2	184	11.5

1/ Estimated number of daily per capita calories calculated by adjusting sugar deliveries for domestic food and beverage use for food losses.
2/ U.S. per capita cane and beet sugar estimated deliveries for domestic food and beverage use, calendar year. See Table 50 of Sugar and Sweetener Yearbook series.
3/ Number of daily teaspoons multiplied by calories per serving.
4/ Grams per day divided by serving weight.
5/ Preliminary.
Source: USDA, ERS, Sugar and Sweeteners Outlook.
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