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Food demand in Australia: trends and issues 2018

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Contents

Sumn	nary	1
1	Introduction	3
2	Australia's food market	4
	Recent trends in Australia's food market	4
	Key drivers of household food demand	9
	International transmission of food prices	11
3	Household characteristics and total food expenditure	12
	Recent trends for all households	12
	Total food expenditure in 2015-16, by income quintile	17
	Total food expenditure in 2015-16, by net worth quintile	19
	Total food expenditure in 2015-16, by age category	21
	Total food expenditure in 2015-16, by source of income	23
4	Household expenditure on main food types	25
	Recent trends for all households	25
	Expenditure on food types in 2015-16, by income quintile	27
	Expenditure on food types in 2015-16, by net worth quintile	29
	Expenditure on food types in 2015-16, by age category	31
	Expenditure on food types in 2015-16, by source of income	33
5	Economic implications for food producers	35
	Australia's household food requirements	35
	Spending more on meals out and fast foods is broadly based	39
	Australia's food price-quality spectrum	41
	Illustrative projections to 2049-50	47
6	Issues	48
	Food security	48
	Food security in Australia's government payment households	49
	Nutrition security	51
	Food losses and waste	54
7	Conclusion	57
Apper	ndix A: Definitions of food expenditure and related measures	58
Apper	ndix B: Value of Australia's food market in 2016-17	60
Apper	ndix C: Household income and expenditure, by data source	61
Apper	dix D: Food expenditure growth rates, 2009-10 to 2015-16	63
Apper	dix E: Indicative price ratios across population sub-groups, 2015-16	66
Apper	dix F: Illustrative framework: pathways to lower expected health risk	67
Refere	ences	69

Tables

Figures

Figure S1 Food expenditure per person in Australia, by main food type, 1988-89 to 2015-161
Figure 1 Australia's food net exports, exchange rate and terms of trade, 1988-89 to 2016-174
Figure 2 Australia's food production and exports, 1988-89 to 2016-177
Figure 3 Australia's food consumption and imports, 1988-89 to 2016-178
Figure 4 Food demand, population growth and food prices in Australia, 1988-89 to 2016-179
Figure 5 Value of household income and food consumption per person, 1988-89 to 2016-1710
Figure 6 Rural commodity and food prices and the US\$/A\$ exchange rate, 1988-89 to 2016-1711
Figure 7 Household expenditure on goods and services per person, 1988-89 to 2015-16
Figure 8 HES data for Australia's household food expenditure and income, 1988-89 to 2015-1614
Figure 9 Australia's household food expenditure and income, by income quintile, 2015-1617

Figure 10 Australia's household food expenditure and income, by net worth quintile, 2015-16	.19
Figure 11 Australia's household food expenditure and income, by age category, 2015-16	21
Figure 12 Australia's household food expenditure and income, by main source of income, 2015-16	.23
Figure 13 Australia's household food expenditure, by main food type, 1988-89 to 2015-16	25
Figure 14 Australia's household food expenditure, by food type and income quintile, 2015-16	.27
Figure 15 Australia's household food expenditure, by food type and net worth quintile, 2015-16	.29
Figure 16 Australia's household food expenditure, by food type and age category, 2015-16	31
Figure 17 Australia's household food expenditure, by food type & main source of income, 2015-16	33
Figure 18 Australia's household food expenditure, by major food group, 1988-89 to 2015-16	35
Figure 19 Real food price indexes, total and meals out & fast foods, 1988-89 to 2016-17	37
Figure 20 Food expenditure per person vs. meals out & fast foods share, by population sub-group, 2009-10 and 2015-16	.39
Figure 21 Total food expenditure vs. meals out & fast foods share, by population sub-group, 2009-10 and 2015-16	.40
Figure 22 Expenditure per person, % Australian average in the same food type, by population sub-group, 2015-16	.43
Figure 23 Australia's food consumption expenditure, by data source, 1988-89 to 2049-50	.47
Figure 24 Food expenditure patterns, government payment households & all households, 2015-16	.49
Figure C1 Overview of Australia's household income account, 1988-89 to 2016-17	.61
Figure C2 Food expenditure share of after-tax income, by data source, 1988-89 to 2016-17	61
Figure C3 Household income and expenditure measures, by data source, 1988-89 to 2016-17	.62

Boxes

Box 1 Simple algebraic relationships between food expenditure and food prices	42
Box 2 Illustrative economic effects of food quality reliability	46
Box 3 Definitions of food security	48
Box 4 Australian Government guidelines for healthy lifestyle choices	53
Box 5 R&D case study: CSIRO research on converting food waste to nutritious food	56

Summary

This report briefly examines recent trends and issues relating to Australia's household food expenditure.

Trends in Australia's food market

Trends in Australia's food market between 1988-89 and 2016-17: indicative food production increased from \$65 billion to \$117 billion, an average increase of 2.1 per cent a year; household food consumption expenditure increased from \$49 billion to \$92 billion, an average increase of 2.3 per cent a year; and net food exports increased from \$16 billion to \$25 billion, an average increase of 1.5 per cent a year (in 2015-16 prices).

• Food exports increased from \$20 billion to \$39 billion (2.4 per cent a year), or from 30 to 33 per cent of indicative food production. Food imports increased from \$4 billion to \$14 billion (4.8 per cent a year), or from 8 to 15 per cent of food consumption.

Key drivers of food demand growth in Australia: estimated growth in the volume of household food consumption has been relatively consistent in recent decades, averaging 2.4 per cent a year over the period 1988-89 to 2016-17, but key drivers have changed.

- Between 1988-89 and 2009-10, key drivers were population growth (55 per cent of food demand growth), income growth (42 per cent), and changes in tastes and preferences (9 per cent), partly offset by higher real food prices (-7 per cent).
- Between 2009-10 and 2016-17, key drivers were population growth (64 per cent of food demand growth), changes in tastes and preferences (20 per cent), lower real food prices (10 per cent) and income growth (6 per cent).
- Growth estimates for the volume of food consumption per person (1.0 per cent a year between 1988-89 and 2016-17) should be interpreted with caution and may indicate there has been some switching toward higher-priced food types.

Changing household food expenditure patterns: based on ABS household expenditure survey (HES) data, the trend away from home cooking toward meals out and fast foods has continued in recent years (Figure S1). The share of meals out and fast foods in total food expenditure increased from 25 per cent in 1988-89 to 31 per cent in 2009-10 and 34 per cent in 2015-16, the latest year available. That is, on average, consumers have switched further from food products toward higher-priced food services—between 1988-89 and 2015-16, real consumer prices increased overall by 5 per cent for food and 17 per cent for meals out and take away food.



Figure S1 Food expenditure per person in Australia, by main food type, 1988-89 to 2015-16

Note: Listed by value in 2009-10. Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages. Sources: ABS 2017a,b

Economic opportunities for food producers: future food demand growth will be underpinned by population growth. A key uncertainty in the outlook is the extent to which the broadly-based trend toward spending more on meals out and fast foods will continue.

- Under illustrative medium-case projections, Australia's household food consumption expenditure increases from \$92 billion in 2016-17 to \$165 billion in 2049-50, an average increase of 1.8 per cent a year; this comprises growth rates of 1.3 per cent for the population (ABS Series B population projections), and 0.5 per cent for household food expenditure per person (average of recent and longer-term trend growth).
- There are significant market segments across the food price-quality spectrum. Price is the key driver of food demand in several population sub-groups, particularly lower income and net worth households, while there is a revealed willingness to pay a price premium for quality attributes in higher income and net worth households. Reliable food quality is likely to increase the willingness of people to pay a price premium (all else constant).

Issues

Food security in government payment households: based on HES data, in households where government payments are the main income source, on average, the share of household income spent on food has declined significantly, from 29 per cent in 1988-89 to 21 per cent in 2009-10 and 19 per cent in 2015-16. The main difference in food expenditure patterns from the average Australian household is spending on meals out and fast foods. For example, in 2015-16, expenditure per person in government payment households, as a share of the Australian average, was 74 per cent for total food, 90 per cent for food excluding meals out and fast foods, and 42 per cent for meals out and fast foods. Some households may still require complementary support, for example, from non-government organisations.

Nutrition security: in recent years, globally, there has been a significant focus on the role of nutrition in food security and health outcomes. Modern food systems are associated with lower levels of undernutrition—including deficiencies in macronutrients (proteins, carbohydrate and fats) and micronutrients (vitamins and minerals)—and higher levels of overweight and obesity, and diet-related non-communicable diseases. The Australian Government Department of Health has a website with guidelines on healthy lifestyle choices for various population groups, including information on nutrition and physical activity.

- There may be a useful role for government to provide more nuanced and accessible information about diet and lifestyle attributes than is currently available to encourage people to make incremental choices that lower expected health risks, taking into account their individual circumstances (including tastes and preferences).
- Given the importance of meals out and fast foods in household food consumption, there may be a useful role for government to consider cost-effective options to provide consumers with information about nutrition content and food source in the food services industry (for example, through a healthy star rating system and origin labelling).

Food waste and losses: global food losses and waste account for around one-third of food produced for human consumption; in North America and Oceania (including Australia), around 13 per cent of initial food production is wasted at the consumption stage. Australia's National Food Waste Strategy, launched in November 2017, aims to halve food waste by 2030; the Strategy presents a framework to support policy options to reduce food waste. An example of current CSIRO research that aims to reduce food waste is the processing of pulp that remains after juicing.

• Reliable food product and service labelling will allow consumers to make food choices that, for a given price, are more closed aligned with their tastes and preferences, reducing food waste (all else constant).

1 Introduction

In June 2017, ABARES released a report that examined recent trends in food demand in Australia and a range of food security issues (see Hogan 2017). This report provides updated information on Australia's food market and household food expenditure patterns, including estimates of key drivers of food demand growth in recent decades (unless otherwise specified, food excludes alcoholic beverages). Notably, food expenditure patterns across four population sub-groups are examined using the most recent ABS household expenditure survey (HES) data for 2015-16 (released in late 2017; ABS 2017a). Population sub-groups include household income, household net worth, age category and main source of income (including households highly reliant on government pensions and allowances). In this report, real values are reported in 2015-16 prices (nominal values are adjusted for inflation using the consumer price index).

Food is a necessity good overall, although food products and services may vary widely in terms of price and quality. At a minimum, food is required to meet the basic energy and nutrition needs of people. However, total food demand is influenced by a range of factors, including population size, consumer incomes, food prices, food quality, and consumer tastes and preferences (including lifestyle choices).

The information in this report is relevant to two key aspects of the food market.

- **Food security**—is there a reasonable level of food security, based on average food expenditure per person, in each population sub-group? The economic justification for transfer payments to low-income households is based on equity considerations.
- **Economic opportunities for farmers and other food providers**—are there significant population sub-groups where there is a revealed preference, at least on average, to pay more for food products and/or services with reliable quality attributes? This information is relevant for considering future market developments and the extent to which there may be economic opportunities for Australia's farmers, food producers and others in the domestic food supply chain to value add.

An important issue for Australian food producers is that a potential price premium for food quality is dependent on consumers (in either the domestic or export market) having relevant information about the quality attributes of Australian food produce (or food products and/or services more broadly). Food labelling is an important method used to identify quality attributes that have the potential to earn a price premium in the end use market.

The structure of the report is as follows.

- **Trends (chapters 2-4)**—chapter 2 briefly examines recent trends in Australia's food market; information on household food expenditure patterns across population sub-groups is presented in chapter 3 (total food expenditure) and chapter 4 (eight main food types). Definitions of the main ABS terms used in these chapters are given in appendix A.
- **Economic implications for food producers (chapter 5)**—chapter 5 briefly examines some key economic implications of household food expenditure trends.
- **Issues (chapter 6)**—chapter 6 briefly examines food security in households highly reliant on government payments, nutrition security, and food losses and waste.

Some concluding comments are provided in chapter 7.

2 Australia's food market

This chapter provides an overview of trends in Australia's food market, key influences on household food consumption and the international transmission of food prices.

Recent trends in Australia's food market

Food net exports

In broad terms, long-term trends in Australia's food market were disrupted by the economywide effects of the resources boom in the millennium decade. The large rise in Australia's terms of trade—defined as the price of exports relative to the price of imports—occurred mainly as a result of higher non-renewable resource prices, providing the economic incentive for increased investment in Australia's resources sector. Two key economy-wide effects of the resources boom in the millennium decade were the increase in Australia's real exchange rate that reduced the international price competitiveness of other export and import-competing industries (all else constant), and strong income growth that increased domestic demand for goods and services.

The timing of these changes in trend are summarised most clearly by movements in Australia's food net exports (Figure 1). Australia's food net exports increased from \$16 billion in 1988-89 to a peak of \$28 billion in 2001-02 and fell to a recent low of \$15 billion in 2009-10, but have since recovered to \$25 billion in 2016-17 (in 2015-16 prices; Table 1). Between 1988-89 and 2016-17, food net exports increased by 1.5 per cent a year on average—4.3 per cent between 1988-89 and 2001-02, -7.5 per cent between 2001-02 and 2009-10 and 7.3 per cent between 2009-10 and 2016-17 (Table 2; referred to as the three sub-periods in the rest of this chapter).

The recent strong recovery in food net exports indicates Australia continues to have an important international competitive advantage in food production. In 2016-17, Australia recorded net exports of \$13.0 billion for crop-based food and \$12.6 billion for livestock-based food, and net imports of \$0.7 billion for fisheries-based food (see Table B1 in appendix B for more detailed food trade data).



Figure 1 Australia's food net exports, exchange rate and terms of trade, 1988-89 to 2016-17

Note: Values are in 2015-16 prices; CPI-adjusted data. Index base: 2015-16=100. Food includes non-alcoholic beverages. The real exchange rate is the trade-weighted value of the A\$ where nominal exchange rates are adjusted for relative consumer price levels. Australia's terms of trade is the ratio of export prices to import prices. Sources: ABARES 2017; ABS 2018a, 2017b,c; RBA statistics

Table 1 Key economic indicators for Australia's food market, 1988-89 to 2016-17

Variable	Unit	1988-89	2001-02	2009-10	2015-16	2016-17
Selected indicators						
Population and prices						
Resident population	million	16.7	19.4	21.9	24.0	24.4
Real food price index	index no.	95.3	99.2	105.2	100.0	100.1
Real exchange rate	index no.	87.5	71.7	108.3	100.0	104.7
Terms of trade	index no.	79.5	76.1	117.7	100.0	114.7
Food production and trade						
Indicative food production	\$b	65.2	93.3	97.7	113.1	116.7
Food trade						
Net exports	\$b	16.0	27.8	14.9	22.0	24.5
Exports	\$b	19.9	34.7	24.9	36.5	38.7
Imports	\$b	3.9	6.8	9.9	14.5	14.2
Food trade shares						
Exports, % of production	%	30.4	37.1	25.5	32.3	33.2
Imports, % of consumption	%	7.8	10.5	12.0	15.9	15.4
Household income and expenditure						
Per person						
Gross income	\$	40,206	47,250	58,332	61,307	60,801
Gross income after income tax	\$	34,083	40,461	51,530	53,191	52,616
Final consumption expenditure	\$	25,223	32,267	38,203	40,315	40,215
Food consumption expenditure						
Value	\$	2,950	3,378	3,787	3,794	3,779
Volume index	index no.	100	114	124	132	132
Total						
Gross income	\$b	671	916	1,275	1,472	1,483
Gross income after income tax	\$b	569	784	1,127	1,277	1,283
Final consumption expenditure	\$b	421	626	835	968	981
Food consumption expenditure						
Value	\$b	49	65	83	91	92
Volume index	index no.	100	132	162	190	192
Value of food consumption as						
% of after-tax income	%	8.7	8.3	7.3	7.1	7.2
% of total consumption	%	11.7	10.5	9.9	9.4	9.4

Note: Average annual growth rates. Based on values in 2015-16 prices; CPI-adjusted data. Food excludes alcoholic beverages. Population is mid financial year (December). The real food price index is the CPI for food and non-alcoholic beverages divided by the CPI for all groups multiplied by 100; Base: 2015-16=100. Real exchange rate is the real trade-weighted index of the Australian dollar. Australia's terms of trade for goods and services is the ratio of export prices to import prices. Volume index of food consumption is the chain volume measure of household food consumption expenditure converted to an index with 1988-89=100. Food shares based on value data.

Sources: ABARES 2017; ABS 2018a, 2017b,c; RBA statistics

Table 2 Key indicators for Australia's food market, 1988-89 to 2016-17: growth rates

		Sub-p				
Variable	1988-89 to 2001-02	2001-02 to 2009-10	2009-10 to 2015-16	2009-10 to 2016-17	1988-89 to 2015-16	1988-89 to 2016-17
	%	%	%	%	%	%
Selected indicators						
Population and prices						
Resident population	1.2	1.5	1.6	1.6	1.4	1.4
Real food price index	0.3	0.7	-0.8	-0.7	0.2	0.2
Real exchange rate	-1.5	5.3	-1.3	-0.5	0.5	0.6
Terms of trade	-0.3	5.6	-2.7	-0.4	0.9	1.3
Food production and trade						
Indicative food production	2.8	0.6	2.5	2.6	2.1	2.1
Food trade						
Net exports	4.3	-7.5	6.7	7.3	1.2	1.5
Exports	4.4	-4.1	6.6	6.5	2.3	2.4
Imports	4.5	4.8	6.5	5.2	5.0	4.8
Food trade shares						
Exports, % of production	-	-	-	-	-	-
Imports, % of consumption	-	-	-	-	-	-
Household income and expend	liture					
Per person						
Gross income	1.2	2.7	0.8	0.6	1.6	1.5
Gross income after income tax	1.3	3.1	0.5	0.3	1.7	1.6
Final consumption expenditure	1.9	2.1	0.9	0.7	1.8	1.7
Food consumption expenditure						
Value	1.0	1.4	0.0	0.0	0.9	0.9
Volume index	1.0	1.1	1.1	0.9	1.0	1.0
Total						
Gross income	2.4	4.2	2.4	2.2	3.0	2.9
Gross income after income tax	2.5	4.6	2.1	1.9	3.0	2.9
Final consumption expenditure	3.1	3.7	2.5	2.3	3.1	3.1
Food consumption expenditure						
Value	2.2	3.0	1.6	1.5	2.3	2.3
Volume index	2.2	2.6	2.6	2.4	2.4	2.4
Value of food consumption as						
% of after-tax income	-	-	-	-	-	-
% of total consumption	-	-	-	-	-	-

Note: Average annual growth rates. Based on values in 2015-16 prices; CPI-adjusted data. Food excludes alcoholic

beverages. Population is mid financial year (December). The real food price index is the CPI for food and non-alcoholic beverages divided by the CPI for all groups multiplied by 100; Base: 2015-16=100. Real exchange rate is the real trade-weighted index of the Australian dollar. Australia's terms of trade for goods and services is the ratio of export prices to import prices.

Sources: ABARES 2017; ABS 2018a, 2017b,c; RBA statistics

Food production and exports

Australia's food production continued to increase in the millennium decade but at a slower rate than in the previous decade; slower growth was to some extent the result of prolonged and widespread drought conditions (Hogan and Morris 2010). The impact of a higher real exchange rate in the millennium decade on the international price competitiveness of Australia's food industry was also offset, at least to some extent, by a global food price boom in the latter half of the decade (discussed briefly at the end of this chapter). Indicative food production increased from \$65 billion in 1988-89 to \$117 billion in 2016-17, or 2.1 per cent a year on average with growth rates of 2.8 per cent, 0.6 per cent and 2.6 per cent in the three sub-periods (in 2015-16 prices; Table 1, Table 2, Figure 2).

Food exports fell during the millennium decade as more food was diverted to the strongly growing domestic market. With slower growth in domestic food demand and subsequently a lower real exchange rate, food exports increased again after 2009-10 and were higher in recent years than in 2001-02, the previous peak (Figure 2). Food exports increased from \$20 billion in 1988-89 to \$35 billion in 2001-02, fell to \$25 billion in 2009-10, but have since recovered to \$39 billion in 2016-17. Between 1988-89 and 2016-17, food exports increased by 2.4 per cent a year on average—4.4 per cent, -4.1 per cent and 6.5 per cent in the three sub-periods.

These recent trends highlight the flexibility of Australia's food industry to respond to changes in economic circumstances. The food industry became progressively more export-oriented during the 1990s, but this trend was temporarily reversed during the millennium decade. Food exports, as a share of the value of indicative food production, were 30 per cent in 1988-89, 37 per cent in 2001-02, 25 per cent in 2009-10 and 33 per cent in 2016-17 (Table 1, Figure 2).

In 2016-17, Australia was a net exporter in nine food categories: grains and oilseeds (\$10.7 billion), meat processing (\$10.4 billion), sugar (\$2.2 billion), live animals except fish (\$1.3 billion), fish or shellfish (unprocessed fisheries-based food, \$1.0 billion), unprocessed fruit and vegetables (\$0.9 billion), milk and cream processing (\$0.9 billion), flour mill and cereal food (\$0.4 billion), and poultry processing (\$0.1 billion) (net exports in other processed food, including dairy products, were also significant) (Table B1).



Figure 2 Australia's food production and exports, 1988-89 to 2016-17

Note: Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages. Indicative food production is calculated as household food consumption minus imports plus exports. Sources: ABARES 2017; ABS 2017b,c

Food consumption and imports

In contrast to Australia's food production, household food consumption expenditure increased more strongly in the millennium decade (Table 1 and Table 2, Figure 3). Household food consumption expenditure increased from \$49 billion in 1988-89 to \$92 billion in 2016-17, or by 2.3 per cent a year on average, with growth rates of 2.2 per cent, 3.0 per cent and 1.5 per cent in the three sub-periods (see also Figure C1 in appendix C).

Australian consumers source most of their food from the domestic food industry, although there has been a relatively steady increase in imports in recent decades Figure 3. Food imports increased from \$4 billion in 1988-89 to \$7 billion in 2001-02, \$10 billion in 2009-10 and \$14 billion in 2016-17. Between 1988-89 and 2016-17, food imports increased by 4.8 per cent a year on average—4.5 per cent, 4.8 per cent and 5.2 per cent in the three sub-periods.

Overall, the share of imports in household food consumption expenditure increased from 8 per cent in 1988-89 to 10 per cent in 2001-02, 12 per cent in 2009-10 and 15 per cent in 2016-17.

In 2016-17, Australia was a significant net importer in six categories (Table B1 in appendix B):

- seafood (processed fisheries-based food, \$1.6 billion)
- processed fruit and vegetables (\$1.3 billion)
- soft drink, cordials and syrups (\$0.8 billion)
- confectionery (\$0.6 billion)
- bakery products (\$0.5 billion)
- oils and fats (\$0.3 billion).

Food imports provide domestic consumers and food service providers with access to a wider range of food products than would otherwise be the case.



Figure 3 Australia's food consumption and imports, 1988-89 to 2016-17

Note: Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages. Sources: ABARES 2017; ABS 2017b,c

Key drivers of household food demand

Annual growth in the volume of food consumption—a key indicator of food demand growth has been relatively steady in recent decades, averaging 2.4 per cent in aggregate and 1.0 per cent on a per person basis (Figure 4). By contrast, the real value of household food consumption expenditure per person increased from \$2950 in 1988-89 to \$3787 in 2009-10 and has levelled off in recent years (Figure 5). Three key influences on food demand growth are population growth, changes in real food prices (Figure 4) and real income growth (Figure 5).

Between 1988-89 and 2016-17, Australia's resident population increased by 1.4 per cent a year on average (Table 2). The influence of population growth on food demand growth is indicated by the gap between the volume of total food consumption and the volume of food consumption per person in Figure 4 (where each variable is expressed as an index with 1988-89 as the base year). Overall, there has been an increase in real food consumer prices (0.2 per cent) and real after-tax income per person (1.6 per cent), although there have been significant changes in trend in both cases—real food consumer prices increased in the 2000s and fell in the 2010s to date (discussed further in the next section), and real after-tax income per person increased strongly in the 2000s, associated with the resources boom, and has levelled off in recent years.

An approximate decomposition of food demand growth may be calculated in two stages.

- 1. The growth rate for the volume of total food consumption is approximately equal to the population growth rate plus the growth rate for the volume of food consumption per person.
- 2. The growth rate for the volume of food consumption per person is approximately equal to the sum of three components—an income growth component (calculated by applying an income elasticity of demand estimate), a real food price change component (calculated by applying a price elasticity of demand estimate) and a residual component (notably, changes in tastes and preferences).

The income and price elasticity of demand estimates are taken from a 2011 USDA study—a 1 per cent increase in income or price, all else constant, is estimated to result in a 0.495 per cent or -0.325 per cent change in demand in the food, beverages and tobacco industry (Muhammad et al 2011, see also appendix B in Hogan 2017).



Figure 4 Food demand, population growth and food prices in Australia, 1988-89 to 2016-17

Note: Chain volume measure of household food consumption expenditure. Index base: 1988-89=100. Sources: ABS 2017c,d, 2014



Figure 5 Value of household income and food consumption per person, 1988-89 to 2016-17

Note: In 2015-16 prices; CPI-adjusted data. Food excludes alcoholic beverages. Sources: ABS 2017b,c

Estimates of the impact of key influences on food demand growth in Australia are presented in Table 3 for selected time periods. Between 1988-89 and 2009-10, key drivers of food demand growth were population growth (accounting for 55 per cent of growth in the volume of total food consumption), real income growth (42 per cent), and a residual factor that captures changes in tastes and preferences including lifestyle choices (9 per cent), while higher real food prices detracted from food demand growth (-7 per cent) (some rounding error). By contrast, between 2009-10 and 2016-17, key drivers of food demand growth were population growth (64 per cent), changes in tastes and preferences (20 per cent), lower real food prices (10 per cent) and real income growth (6 per cent).

			Sub-periods			
Variable	Unit	1988-89 to 2009-10	2009-10 to 2015-16	2009-10 to 2016-17	1988-89 to 2015-16	1988-89 to 2016-17
Food demand						
Volume of food consumption	%	2.34	2.64	2.44	2.41	2.36
Key influences - percentage poi	int contributio	on to food dema	nd			
Population	% points	1.30	1.57	1.57	1.36	1.36
Income	% points	0.98	0.26	0.15	0.82	0.77
Price	% points	-0.15	0.27	0.23	-0.06	-0.06
Other (tastes and preferences)	% points	0.21	0.53	0.49	0.28	0.28
Sum of above	% points	2.34	2.64	2.44	2.41	2.36
Key influences - percentage cor	ntribution to f	ood demand				
Population	%	55.4	59.6	64.4	56.4	57.7
Income	%	42.1	9.9	6.1	34.2	32.7
Price	%	-6.6	10.3	9.5	-2.4	-2.4
Other (tastes and preferences)	%	9.1	20.1	20.1	11.8	12.0
Sum of above	%	100.0	100.0	100.0	100.0	100.0

Table 3 Estimates of key influences on Australia's food demand, 1988-89 to 2016-17

Note: Average annual growth rate for food demand. Key variables are: chain volume measure of household food consumption expenditure (food demand); Australia's resident population (population); gross income after income tax per person (income); real food price index (price).

Sources: Based on data in ABS 2017b,c,d, 2014; Muhammad et al 2011

International transmission of food prices

World food prices summarise supply and demand conditions in the world food market given policy settings in developed and developing economies. Changes in food prices provide important economic signals to both food producers and consumers. For example, higher food prices, if sustained, provide economic incentives for: farmers to increase food production; consumers to switch to lower cost food options (if possible); and for all food market participants to reduce losses and waste in food production, distribution and use (estimates of global food losses and waste are provided in, for example, FAO 2011).

As outlined in Hogan (2017), OECD (2015) provides an overview of issues relating to world food price formation and transmission along the food supply chain including, for example, the level and volatility of world food prices. There are two key components of international food price transmission.

- **Horizontal price transmission**—refers to spatial aspects of price transmission whereby the price of a food product in two separate geographic locations may largely reflect differences in transport costs (although other supply costs may vary between locations); issues include, for example, the international transmission of food price volatility.
- **Vertical price transmission**—refers to price transmission along the food supply chain; issues, include, for example, the impact of the functioning of the food supply chain and the regulatory environment.

Notably, in the 2000s (the millennium decade), a world food price boom largely offset the impact of a strong appreciation of the Australian dollar on domestic prices. In Figure 6, this is indicated by the divergence between the US\$ rural commodity price index (US dollar index) and the A\$ rural commodity price index (Australian dollar index).

Figure 6 Rural commodity and food prices and the US\$/A\$ exchange rate, 1988-89 to 2016-17



Note: Index base: 2015-16 =100. Food excludes alcoholic beverages. The real food consumer price index (CPI) is the CPI for food and non-alcoholic beverages divided by the CPI for all groups multiplied by 100. Sources: ABS 2017b, RBA statistics

3 Household characteristics and total food expenditure

This chapter briefly examines total food expenditure in Australia across a range of household types (population sub-groups) using 2015-16 ABS household expenditure survey (HES) data (ABS 2017a).

Recent trends for all households

Consistent with the approach in Hogan (2017), average weekly expenditure and income data available in ABS (2017a) are converted to annual data (per person and total). Notably, there are significant differences with aggregate national accounts data for key income and expenditure variables, mainly because of differences in definitions and methods used to collect the data, although overall trends are similar (Figure C2 and Figure C3 in appendix C; ABS 2011).

Household expenditure on goods and services

Based on HES data, household expenditure on goods and services per person increased from \$19,759 in 1988-89 to \$28,577 in 2009-10, and then fell marginally to \$28,499 in 2015-16 (Figure 7). Food was the second highest expenditure category in 2015-16 and 2009-10, but was the highest category in 2003-04 and previous HES years. In 2015-16, four broad expenditure categories accounted for 63 per cent of total household expenditure on goods and services: current housing costs (20 per cent), food and non-alcoholic beverages (17 per cent), transport (15 per cent) and recreation (12 per cent) (Table 4). In each of the past six surveys, these are consistently the top ranked expenditure categories.



Figure 7 Household expenditure on goods and services per person, 1988-89 to 2015-16

Note: Values are in 2015-16 prices; CPI-adjusted data. Broad expenditure groups are listed by value in 2015-16; groups comprising less than 5% of total goods and services expenditure are included in the other category. Sources: ABS 2017a,b

Table 4 Australia's goods and services expenditure per person, by group, 1988-89 to 2015-16

		Average expenditure					
Broad expenditure group		Sub-periods			per person, 2015-16		
	1988-89 to 1998-99	1998-99 to 2009-10	2009-10 to 2015-16	1988-89 to 2015-16	Value	Share of total	
	%	%	%	%	\$	%	
Current housing costs	1.0	4.7	1.3	2.6	5,582	19.6	
Food and non-alcoholic beverages	0.7	1.4	0.1	0.9	4,739	16.6	
Transport	2.3	1.5	-1.3	1.2	4,134	14.5	
Recreation	1.9	2.1	-0.6	1.4	3,437	12.1	
Medical care and health expenses	2.0	3.5	1.4	2.5	1,647	5.8	
Household furnishings and equipment	-1.0	0.0	-2.1	-0.9	1,157	4.1	
Communication	5.4	3.5	-0.8	3.2	932	3.3	
Household services and operation	2.2	1.5	1.9	1.8	898	3.2	
Education	6.0	5.0	3.7	5.1	877	3.1	
Clothing and footwear	-1.7	0.1	-2.6	-1.2	875	3.1	
Domestic fuel and power	1.2	2.5	1.4	1.8	818	2.9	
Alcoholic beverages	-0.2	1.2	-2.6	-0.1	639	2.2	
Personal care	1.2	2.2	0.5	1.4	573	2.0	
Tobacco products	2.4	-1.5	-2.0	-0.2	257	0.9	
Miscellaneous goods and services	0.8	3.1	-0.4	1.5	1,941	6.8	
Total goods and services expenditure	1.2	2.3	0.0	1.4	28,499	100.0	

Note: Average annual growth rates, based on values in 2015-16 prices; CPI-adjusted data. Broad expenditure groups are listed by value in 2015-16. Current housing costs (selected dwelling).

Sources: ABS 2017a,b

Household food expenditure

Based on HES data, household food expenditure per person increased from \$3767 in 1988-89 to \$4739 in 2015-16 (in 2015-16 prices; includes non-alcoholic beverages; Table 5)—these estimates are higher than the corresponding national accounts data in Table 1. The average growth rate over the period was 0.9 per cent a year for both HES and national accounts data (Table 6 and Table 2).

Household income per person, both before and after income tax, increased over the period, although HES estimates are lower than the corresponding national accounts data. Based on HES data, household income per person before and after income tax increased by 1.9 and 2.0 per cent, respectively, between 1988-89 and 2015-16 (Figure 8a, Table 6)—these growth rates are slightly higher than the corresponding national accounts data (Table 2).

In aggregate, HES estimates of household income, both before and after tax, and household expenditure on goods and services are consistently below the corresponding national accounts data—in 2015-16, the difference was about \$0.5 trillion for the income measures (Figure C3a) and \$0.3 trillion for total expenditure (Figure C3b). By contrast, HES estimates of household food expenditure are consistently above the corresponding national accounts data—in 2015-16, the difference was about \$18 billion (Figure C3c).

Overall, food expenditure accounts for a higher share of after-tax income using HES data compared with national accounts data, although trends between 1988-89 and 2015-16 are

similar (Figure C2). Based on HES estimates, household food expenditure as a share of after-tax income fell from 19 per cent in 1988-89 to 14 per cent in 2015-16 (Figure 8b, Table 5).

An overview of Australia's household income account based on national accounts data is presented in Figure C1 in appendix C. To the extent that the income and expenditure shortfalls in the HES data indicate extreme high-income households are under-represented in the survey, the HES data presented in the remainder of this report may need to be interpreted with some caution. However, the HES data is a key data source for examining household food expenditure patterns across a range of household characteristics such as income, net worth and age of reference person.

6,000 60,000 Average food expenditure per person 40,000 4,000 2015-16 \$ 2015-16 Average income per person (right axis) 2,000 20,000 Average after-tax income per person (right axis) 0 0 1988-89 1993-94 1998-99 2003-04 2009-10 2015-16 b) Total 125 25 100 20 Total food expenditure 215-16 \$b 75 15 % Food expenditure, % of 50 10 after-tax household income (right axis) 25 5 0 0 1988-89 1993-94 1998-99 2003-04 2009-10 2015-16

Figure 8 HES data for Australia's household food expenditure and income, 1988-89 to 2015-16

Note: Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages. Sources: ABS 2017a,b

a) Per person

Table 5 Australia's household food expenditure and related indicators, selected years

Variable	Unit	1988-89	1998-99	2009-10	2015-16
Selected indicators					
Demographic indicators					
No. households	million	5.4	7.1	8.4	9.0
No. persons	million	15.1	18.5	21.6	23.3
Average no. of persons in household	no.	2.8	2.6	2.6	2.6
Average age of reference person	years	47	48	50	51
Consumer prices					
Consumer price index (all groups)	no.	47.6	62.6	87.5	100.0
Food consumer price index	no.	45.3	61.4	92.0	100.0
Real food consumer price index	no.	95.3	98.1	105.2	100.0
Gross household income and net assets					
Before income tax					
Average household income	\$	69,514	73,510	100,243	108,472
Average income per person	\$	24,998	28,280	38,995	41,717
Total household income	\$b	377	524	842	972
Income tax					
Average household income tax	\$	13,883	14,830	15,461	19,930
Average income tax per person	\$	4,993	5,705	6,014	7,665
Total household income tax	\$b	75	106	130	179
After income tax					
Average after-tax household income	\$	55,631	58,680	84,782	88,542
Average after-tax income per person	\$	20,005	22,575	32,981	34,053
Total after-tax household income	\$b	302	418	712	793
Average household net worth					
Average household net worth	\$'000	-	-	833	892
Average household net worth per person	\$'000	-	-	324	343
Total household net worth	\$b	-	-	7,000	7,992
Household expenditure					
Goods and services					
Average household expenditure	\$	54,945	58,066	73,461	74,102
Average expenditure per person	\$	19,759	22,338	28,577	28,499
Total expenditure on goods & services	\$b	298	414	617	664
% of total after-tax household income	%	98.8	99.0	86.6	83.7
Food					
Average household food expenditure	\$	10,474	10,550	12,134	12,322
Average food expenditure per person	\$	3,767	4,059	4,720	4,739
Total food expenditure	\$b	57	75	102	110
% of total after-tax household income	%	18.8	18.0	14.3	13.9
% of expenditure on goods & services	%	19.1	18.2	16.5	16.6

Note: Values are in 2015-16 prices; CPI-adjusted data. The real exchange rate is the trade-weighted value of the Australian dollar where nominal exchange rates are adjusted for relative consumer price levels; March 1995=100; average data. The real food consumer price index is the CPI for food and non-alcoholic beverages divided by the CPI for all groups multiplied by 100; Base: 2015-16=100.

Sources: ABS 2017a,b

Table 6 Australia's household food expenditure and related indicators: growth rates

Variable	1988-89 to 1998-99	1998-99 to 2009-10	2009-10 to 2015-16	1988-89 to 2015-16
	%	%	%	%
Selected indicators				
Demographic indicators				
No. households	2.8	1.5	1.1	1.9
No. persons	2.1	1.4	1.3	1.6
Average no. of persons in household	-	-	-	-
Average age of reference person	-	-	-	-
Consumer prices				
Consumer price index (all groups)	2.8	3.1	2.2	2.8
Food consumer price index	3.1	3.7	1.4	3.0
Real food consumer price index	0.3	0.6	-0.8	0.2
Gross household income and net assets				
Before income tax				
Average household income	0.6	2.9	1.3	1.7
Average income per person	1.2	3.0	1.1	1.9
Total household income	3.3	4.4	2.4	3.6
Income tax				
Average household income tax	0.7	0.4	4.3	1.3
Average income tax per person	1.3	0.5	4.1	1.6
Total household income tax	3.4	1.9	5.5	3.3
After income tax				
Average after-tax household income	0.5	3.4	0.7	1.7
Average after-tax income per person	1.2	3.5	0.5	2.0
Total after-tax household income	3.3	5.0	1.8	3.6
Average household net worth				
Average household net worth	-	-	1.1	-
Average household net worth per person	-	-	0.9	-
Total household net worth	-	-	2.2	-
Household expenditure				
Goods and services				
Average household expenditure	0.6	2.2	0.1	1.1
Average expenditure per person	1.2	2.3	0.0	1.4
Total expenditure on goods & services	3.3	3.7	1.2	3.0
% of total after-tax household income	-	-	-	-
Food				
Average household food expenditure	0.1	1.3	0.3	0.6
Average food expenditure per person	0.7	1.4	0.1	0.9
Total food expenditure	2.8	2.8	1.3	2.5
% of total after-tax household income	-	-	-	-
% of expenditure on goods & services	-	-	-	-

Note: Average annual growth rates; based on values in 2015-16 prices; CPI-adjusted data.

Sources: ABS 2017a,b

Total food expenditure in 2015-16, by income quintile

In this section, household food expenditure patterns are briefly examined where households are divided into five groups, or quintiles, based on gross household income. Quintile 1, for example, includes the 20 per cent of households with the lowest gross household income. Although there are the same number of households in each quintile, the number of people living in these households increases with income quintile—in 2015-16, population ranged from 2.6 million persons in income quintile 1 to 6.2 million persons in income quintile 5 (Table 7).

Average income per person, both before and after income tax, increases with income quintile (Figure 9a). With the exception of the lowest income quintile, food expenditure per person also increases with income quintile—in 2015-16, average food expenditure per person ranged from \$4077 in quintile 1 and \$3901 in quintile 2 to \$5901 in quintile 5.



Figure 9 Australia's household food expenditure and income, by income quintile, 2015-16

Note: Current prices. Food includes non-alcoholic beverages. Each quintile comprises 20% of households based on gross household income where quintile 1 is the lowest 20% and quintile 5 is the highest 20% of households. Source: ABS 2017a

Food expenditure in income quintile 1 is likely to be influenced by a number of older people who have retired but are drawing on lifetime savings to maintain living standards (consistent with the lifecycle hypothesis)—in income quintile 1, average net worth per person was second highest (after income quintile 5), and goods and services expenditure was 137 per cent of after-tax income. Overall, food expenditure as a share of after-tax income falls sharply with income quintile, from 25 per cent in income quintile 1 to 11 per cent in income quintile 5 (Figure 9b).

Total food expenditure increases with income quintile, ranging from \$11 billion in income quintile 1 to \$36 billion in income quintile 5. There is likely to be a significant market for higher quality food products and services, particularly in the two highest income quintiles.

Variable	Unit		Gross hou	ross household income quintile			
Variable	ome	1	2	3	4	5	
Demographic indicators							
No. households	million	1.8	1.8	1.8	1.8	1.8	
No. persons	million	2.6	3.9	4.9	5.7	6.2	
Average no. of persons in household	no.	1.5	2.2	2.7	3.2	3.4	
Average age of reference person	years	62	54	48	45	47	
Gross household income and net assets							
Before income tax							
Average household income	\$	24,128	50,024	83,824	129,012	256,256	
Average income per person	\$	16,571	22,878	30,817	40,644	74,329	
Total household income	\$b	43	90	151	231	459	
Income tax							
Average household income tax	\$	150	2,791	10,820	22,832	63,256	
Average income tax per person	\$	103	1,276	3,978	7,193	18,348	
Total household income tax	\$b	0.3	5	19	41	113	
After income tax							
Average after-tax household income	\$	23,978	47,233	73,004	106,180	193,000	
Average after-tax income per person	\$	16,469	21,602	26,839	33,451	55,981	
Total after-tax household income	\$b	43	85	131	190	346	
Average household net worth							
Average household net worth	\$'000	518	613	706	828	1,834	
Average net worth per person	\$'000	356	280	260	261	532	
Total household net worth	\$b	927	1,102	1,267	1,486	3,285	
Household expenditure on goods and services							
Average household expenditure	\$	32,866	48,585	67,699	87,086	134,631	
Average expenditure per person	\$	22,573	22,220	24,889	27,435	39,051	
Total expenditure on goods & services	\$b	59	87	122	156	241	
% of total after-tax household income	%	137.1	102.9	92.7	82.0	69.8	
Household expenditure on food							
Average household food expenditure	\$	5,936	8,531	11,826	15,048	20,344	
Average food expenditure per person	\$	4,077	3,901	4,348	4,741	5,901	
Total food expenditure	\$b	10.6	15.3	21.2	27.0	36.4	
% of total after-tax household income	%	24.8	18.1	16.2	14.2	10.5	
% of expenditure on goods & services	%	18.1	17.6	17.5	17.3	15.1	

 Table 7 Household characteristics and food expenditure, by income quintile, 2015-16

Note: Current prices. Food includes non-alcoholic beverages. Each quintile comprises 20% of households based on gross household income where, for example, quintile 1 is the lowest 20% of households. Source: ABS 2017a

Total food expenditure in 2015-16, by net worth quintile

In this section, household food expenditure patterns are briefly examined where households are divided into five groups, or quintiles, based on household net worth. Quintile 1, for example, includes the 20 per cent of households with the lowest household net worth. In contrast to income quintiles, the population is relatively evenly distributed across net worth quintiles—in 2015-16, the population ranged from an estimated 4.0 million persons in net worth quintile 1 to 5.1 million persons in net worth quintile 5 (Table 8).

Average income per person, both before and after income tax, increases with net worth quintile (Figure 10a). Food expenditure per person also increases with net worth quintile—in 2015-16, average food expenditure per person ranged from \$3748 in quintile 1 to \$5886 in quintile 5.

Figure 10 Australia's household food expenditure and income, by net worth quintile, 2015-16



Note: Current prices. Food includes non-alcoholic beverages. Each quintile comprises 20% of households based on household net worth where quintile 1 is the lowest 20% and quintile 5 is the highest 20% of households. Source: ABS 2017a

a) Per person

Food expenditure in net worth quintile 1 is likely to be influenced by a number of younger people who may earn reasonable incomes but have yet to accumulate significant assets—in 2015-16, average net worth per person was only \$18,000 in net worth quintile 1. Food expenditure as a share of after-tax income is broadly similar across net worth quintiles, ranging from 15 per cent in net worth quintile 1 to 12 per cent in net worth quintile 5 (Figure 10b).

Total food expenditure increases with net worth quintile, ranging from \$15 billion in net worth quintile 1 to \$30 billion in net worth quintile 5. There is likely to be a significant market for higher quality food products and services in households with high net worth.

Household net worth quintile Variable Unit -1 2 3 4 5 **Demographic indicators** 1.8 No. households million 1.8 1.8 1.8 1.8 No. persons million 4.0 4.9 4.5 4.8 5.1 Average no. of persons in household 2.3 2.7 2.5 2.7 2.9 no. 45 54 57 58 Average age of reference person years 42 Gross household income and net assets Before income tax Average household income \$ 64,220 97,500 94,276 111,436 175,500 Average income per person \$ 28,506 36,057 37,680 41,659 61,273 Total household income \$b 115 175 169 200 314 Income tax Average household income tax \$ 8,023 16,871 19,825 39,393 16,157 Average income tax per person \$ 3,561 6,239 7,411 13,753 6,458 Total household income tax 29 70 \$b 14 30 36 After income tax Average after-tax household income \$ 56,197 80,629 78,119 91,611 136,107 \$ 24,945 29,818 31,222 34,247 Average after-tax income per person 47,520 Total after-tax household income \$b 101 145 140 243 164 Average household net worth Average household net worth \$'000 40 238 527 962 2,696 Average net worth per person \$'000 18 88 211 360 941 Total household net worth \$b 72 427 946 1,724 4,819 Household expenditure on goods and services Average household expenditure \$ 49,384 69,195 66,592 77,334 108,526 \$ Average expenditure per person 21,921 25,589 26,615 28,910 37,890 Total expenditure on goods & services \$b 88 124 119 139 194 % of total after-tax household income % 87.9 85.8 85.2 84.4 79.7 Household expenditure on food Average household food expenditure \$ 8,444 11,342 11,597 13,387 16,858 Average food expenditure per person \$ 3,748 4,194 5,004 5,886 4,635 Total food expenditure 15.1 20.4 20.8 24.0 30.1 \$b % of total after-tax household income % 15.0 14.1 14.8 14.6 12.4 % of expenditure on goods & services % 15.5 17.1 16.4 17.4 17.3

Table 8 Household characteristics and food expenditure, by net worth quintile, 2015-16

Note: Current prices. Food includes non-alcoholic beverages. Each quintile comprises 20% of households based on

household net worth where quintile 1 is the lowest 20% and quintile 5 is the highest 20% of households. Source: ABS 2017a

Total food expenditure in 2015-16, by age category

In this section, household food expenditure patterns are briefly examined where households are divided into seven groups based on the age of the household reference person (main person in the household who is responsible for the dwelling; see appendix A for further information). The number of people living in these households is highest in the 34-44 year and 45-54 year age categories—in 2015-16, there were an estimated 0.6 million persons in the 15-24 year group, 5.7 million persons in the 35-44 year group, 5.5 million persons in the 45-54 year group and 1.5 million persons in the 75 years plus group (Table 9).

Average income per person, both before and after income tax, peaks in the 55-64 year group (Figure 11a). Food expenditure per person is lowest in the 35-44 year and 75 years plus groups (\$4167 and \$4147 in 2015-16), and highest in the 55-64 year group (\$5575).



Figure 11 Australia's household food expenditure and income, by age category, 2015-16

Note: Current prices. Food includes non-alcoholic beverages. Source: ABS 2017a

Food expenditure in the 35-44 year group may be influenced by lifestyle changes, particularly a greater focus on raising children and meeting mortgage commitments, while energy requirements for people in the 75 year plus group may be below the Australian average. Food expenditure as a share of after-tax income is broadly similar across age categories, ranging from 13 per cent (15-24 year and 35-44 year groups) to 15 per cent (65-74 year group) (Figure 11b).

Total food expenditure peaks in the 45-54 year group—in 2015-16, total food expenditure was \$3 billion in the 15-24 year group, \$27 billion in the 45-54 year group and \$6 billion in the 75 year plus group. On average, price is likely to be a major factor in food choices in the 35-44 year group, while there may be a significant market for higher quality food products and services in older households, particularly the 55-64 year group.

Variable	Unit	15–24 years	25-34 years	35-44 years	45-54 years	55–64 years	65–74 years	75 plus years
Demographic indicators								
No. households	million	0.3	1.5	1.7	1.8	1.6	1.2	0.9
No. persons	million	0.6	3.9	5.7	5.5	3.7	2.3	1.5
Average no. of persons in household	no.	2.2	2.7	3.3	3.1	2.4	1.9	1.6
Average age of reference person	years	22	30	40	49	59	69	81
Gross household income and net assets								
Before income tax								
Average household income	\$	90,948	110,760	133,952	138,372	114,712	69,264	49,088
Average income per person	\$	40,816	40,836	40,107	45,349	48,169	36,298	30,728
Total household income	\$b	26	161	228	248	179	84	46
Income tax								
Average household income tax	\$	14,320	20,433	30,589	29,308	19,865	6,171	3,132
Average income tax per person	\$	6,427	7,534	9,159	9,605	8,342	3,234	1,961
Total household income tax	\$b	4	30	52	53	31	8	3
After income tax								
Average after-tax household income	\$	76,628	90,327	103,363	109,064	94,847	63,093	45,956
Average after-tax income per person	\$	34,389	33,302	30,948	35,743	39,827	33,064	28,767
Total after-tax household income	\$b	22	131	176	196	148	77	43
Average household net worth								
Average household net worth	\$'000	124	313	627	1,067	1,290	1,285	1,024
Average net worth per person	\$'000	56	115	188	350	542	673	641
Total household net worth	\$b	35	455	1,068	1,916	2,016	1,565	966
Household expenditure on goods and se	ervices							
Average household expenditure	\$	65,955	77,578	89,213	91,352	75,898	54,625	34,905
Average expenditure per person	\$	29,599	28,602	26,711	29,939	31,870	28,627	21,850
Total expenditure on goods & services	\$b	19	113	152	164	119	67	33
% of total after-tax household income	%	86.1	85.9	86.3	83.8	80.0	86.6	76.0
Household expenditure on food								
Average household food expenditure	\$	10,315	12,456	13,917	14,912	13,277	9,733	6,624
Average food expenditure per person	\$	4,629	4,592	4,167	4,887	5,575	5,101	4,147
Total food expenditure	\$b	2.9	18.1	23.7	26.8	20.7	11.9	6.2
% of total after-tax household income	%	13.5	13.8	13.5	13.7	14.0	15.4	14.4
% of expenditure on goods & services	%	15.6	16.1	15.6	16.3	17.5	17.8	19.0

Table 9 Household characteristics and food expenditure, by age category, 2015-16

Note: Current prices. Food includes non-alcoholic beverages.

Source: ABS 2017a

Total food expenditure in 2015-16, by source of income

In this section, food expenditure patterns in households where government pensions and allowances are the main source of income are briefly examined and compared with outcomes for three private income groups: employee income; own unincorporated business income; and other private income. The distributional effects of Australia's tax-transfer system are illustrated in Figure 12a with significant income tax paid, on average, in private income groups supporting income and food expenditure in government payment households.

In 2015-16, average food expenditure per person ranged from \$3503 in households highly reliant on government payments to \$5671 in other private income households (Table 10). Food expenditure as a share of after-tax income is 19 per cent in households highly reliant on government payments, and ranges between 13 and 15 per cent in private income categories (Figure 12b).



Figure 12 Australia's household food expenditure and income, by main source of income, 2015-16

Note: Current prices. Food includes non-alcoholic beverages. Government payment households are households where government payments and persons are the main source of income. Source: ABS 2017a

Total food expenditure is highest in the employee income group (\$80 billion in 2015-16). Price is likely to be the dominant influence on food choices in households highly reliant on government payments, and this is a significant market in aggregate—in 2015-16, total food expenditure in this group of households was \$15 billion.

Table 10 Household characteristics and food expenditure, by main source of income, 2015-16

		C	Private income				
Variable	Unit	pensions & allowances	Employee income	Own business	Other income	Total	
Demographic indicators							
No. households	million	2.1	5.5	0.4	1.0	6.8	
No. persons	million	4.2	16.1	1.0	1.9	19.1	
Average no. of persons in household	no.	2.0	2.9	2.9	2.0	2.8	
Average age of reference person	years	64	44	45	63	47	
Gross household income and net assets							
Before income tax							
Average household income	\$	36,920	138,112	117,572	97,864	131,248	
Average income per person	\$	18,878	46,933	40,961	49,360	46,825	
Total household income	\$b	79	758	42	94	894	
Income tax							
Average household income tax	\$	211	28,388	25,752	12,985	26,159	
Average income tax per person	\$	108	9,647	8,972	6,549	9,333	
Total household income tax	\$b	0	156	9	13	178	
After income tax							
Average after-tax household income	\$	36,709	109,724	91,820	84,879	105,089	
Average after-tax income per person	\$	18,770	37,286	31,989	42,811	37,492	
Total after-tax household income	\$b	78	602	33	82	716	
Average household net worth							
Average household net worth	\$'000	442	859	945	2,073	1,035	
Average net worth per person	\$'000	226	292	329	1,046	369	
Total household net worth	\$b	940	4,714	340	1,998	7,048	
Household expenditure on goods and se	ervices						
Average household expenditure	\$	35,214	89,272	78,258	72,586	86,356	
Average expenditure per person	\$	18,006	30,336	27,264	36,610	30,809	
Total expenditure on goods & services	\$b	75	490	28	70	588	
% of total after-tax household income	%	96	81	85	86	82	
Household expenditure on food							
Average household food expenditure	\$	6,851	14,584	13,432	11,244	14,049	
Average food expenditure per person	\$	3,503	4,956	4,679	5,671	5,012	
Total food expenditure	\$b	15	80	5	11	96	
% of total after-tax household income	%	19	13	15	13	13	
% of expenditure on goods & services	%	19	16	17	15	16	

Note: Current prices. Food includes non-alcoholic beverages. Own business is own unincorporated business income. Source: ABS 2017a

4 Household expenditure on main food types

This chapter briefly examines household expenditure patterns across eight main food types for all households in recent decades and for each key population sub-group in 2015-16.

Recent trends for all households

Changes in consumer tastes and preferences (including lifestyle choices) may be examined using more detailed HES data on food expenditure. A summary of household food expenditure on eight main food types over the past six HES years is presented in Figure 13. The most notable feature of Australia's changing household food expenditure patterns since the late 1980s is the increase in expenditure on meals out and fast foods (in 2015-16 prices).

Figure 13 Australia's household food expenditure, by main food type, 1988-89 to 2015-16



a) Average expenditure per person





Note: Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages; fruit includes nuts; dairy products includes milk; condiments, confectionary etc. includes food additives and prepared meals. Sources: ABS 2017a,b

Overall, the share of meals out and fast foods in total food expenditure increased from 25 per cent in 1988-89 to 34 per cent in 2015-16 (Table 11). Other main food types include meat, fish and seafood (14 per cent of total food expenditure in 2015-16), fruit and vegetables (13 per cent), condiments, confectionery, food additives and prepared meals (11 per cent), bakery products, flour and cereals (8 per cent), non-alcoholic beverages (6 per cent), dairy products (6 per cent) and other food (8 per cent). Between 1988-89 and 2015-16, food expenditure per person increased for four food types, including other food (3.8 per cent a year on average), meals out and fast foods (2.1 per cent), condiments, confectionery, food additives and prepared meals (1.3 per cent) and fruit and vegetables (0.6 per cent) (discussed further in chapter 5).

Food type	Unit	1988-89	1993-94	1998-99	2003-04	2009-10	2015-16
Average food expenditure per person							
Meals out & fast foods	\$	923	1,028	1,072	1,171	1,455	1,608
Meat, fish & seafood	\$	734	625	599	664	688	650
Fruit & vegetables	\$	518	479	529	567	605	602
Condiments, confectionery etc.	\$	359	431	482	508	525	511
Bakery products, flour & cereals	\$	428	444	484	447	472	397
Non-alcoholic beverages	\$	369	361	404	349	370	300
Dairy products	\$	302	314	336	314	348	302
Other food	\$	134	189	154	234	257	368
Total food	\$	3,767	3,871	4,059	4,254	4,720	4,739
Excluding meals out & fast foods	\$	2,844	2,843	2,986	3,082	3,265	3,131
Total food expenditure							
Meals out & fast foods	\$b	13.9	17.9	19.8	23.0	31.4	37.5
Meat, fish & seafood	\$b	11.1	10.9	11.1	13.0	14.8	15.1
Fruit & vegetables	\$b	7.8	8.3	9.8	11.1	13.1	14.0
Condiments, confectionery etc.	\$b	5.4	7.5	8.9	10.0	11.3	11.9
Bakery products, flour & cereals	\$b	6.4	7.7	9.0	8.8	10.2	9.3
Non-alcoholic beverages	\$b	5.6	6.3	7.5	6.8	8.0	7.0
Dairy products	\$b	4.5	5.5	6.2	6.1	7.5	7.0
Other food	\$b	2.0	3.3	2.9	4.6	5.6	8.6
Total food	\$b	56.8	67.3	75.1	83.4	101.9	110.4
Excluding meals out & fast foods	\$b	42.9	49.4	55.3	60.4	70.5	72.9
Share of total							
Meals out & fast foods	%	24.5	26.6	26.4	27.5	30.8	33.9
Meat, fish & seafood	%	19.5	16.1	14.7	15.6	14.6	13.7
Fruit & vegetables	%	13.7	12.4	13.0	13.3	12.8	12.7
Condiments, confectionery etc.	%	9.5	11.1	11.9	11.9	11.1	10.8
Bakery products, flour & cereals	%	11.4	11.5	11.9	10.5	10.0	8.4
Non-alcoholic beverages	%	9.8	9.3	9.9	8.2	7.8	6.3
Dairy products	%	8.0	8.1	8.3	7.4	7.4	6.4
Other food	%	3.6	4.9	3.8	5.5	5.5	7.8
Total food	%	100.0	100.0	100.0	100.0	100.0	100.0
Excluding meals out & fast foods	%	75.5	73.4	73.6	72.5	69.2	66.1

Table 11 Household food expenditure in Australia, by food type, 1988-89 to 2015-16

Note: Share of total household food expenditure. Food includes non-alcoholic beverages; fruit includes nuts; dairy products includes milk; condiments, confectionery etc. includes food additives and prepared meals. Food types are listed by value in 2009-10 (for consistency with the ranking in Hogan 2017).

Sources: ABS 2017a,b (and previous issues)

Expenditure on food types in 2015-16, by income quintile

Australia's household expenditure on the eight main food types in 2015-16 in each of the five income quintiles is presented in Figure 14 (a more detailed graphical representation of corresponding 2009-10 data is presented in chapter 3 of Hogan 2017). The most notable feature of household expenditure patterns across income groups is the strong revealed preference toward spending on meals out and fast foods, particularly as income increases. Meals out and fast foods is consistently the highest food expenditure category across all quintiles—in 2015-16, expenditure per person on meals out and fast foods ranged from \$913 (22 per cent of total food) in income quintile 1 to \$2406 (41 per cent) in income quintile 5 (Figure 14a, Table 12).

Figure 14 Australia's household food expenditure, by food type and income quintile, 2015-16



a) Average expenditure per person



b) Total expenditure

Note: Current prices. Food includes non-alcoholic beverages. Condiments, confectionery etc. includes food additives and prepared meals. Each quintile comprises 20% of the estimated population based on gross household income where quintile 1 is the lowest 20% and quintile 5 is the highest 20% of households. Source: ABS 2017a Average expenditure per person is highest in income quintile 5 for all food types except dairy products. Food expenditure patterns in income quintile 1 are likely to be influenced by: a significant proportion of relatively low-income people who are drawing on lifetime savings to maintain living standards in retirement; an older average age; and lower reliance on food services (meals out and fast foods) (see also Table 7). Compared with other income groups, average expenditure per person in income quintile 1 is highest on dairy products and second highest on four other food types (meat, fish and seafood; fruit and vegetables condiments, confectionery, food additives and prepared meals; and bakery products, flour and cereals).

Total food expenditure for each food type increases with income quintile (Figure 14b, Table 12).

Table 12 Household food expenditure, by food type and income quintile, 2015-16

		Gross household income quintile				
Variable	Unit	1	2	3	4	5
Average food expenditure per person						
Meals out & fast foods	\$	913	1,033	1,362	1,688	2,406
Meat, fish & seafood	\$	669	596	638	617	722
Fruit & vegetables	\$	633	571	566	569	674
Condiments, confectionery etc.	\$	513	470	494	505	560
Bakery products, flour & cereals	\$	417	375	368	388	437
Non-alcoholic beverages	\$	287	265	304	293	335
Dairy products	\$	328	299	291	290	317
Other food	\$	318	293	324	391	451
Total food	\$	4,077	3,901	4,348	4,741	5,901
Excluding meals out & fast foods	\$	3,164	2,869	2,985	3,052	3,495
Total food expenditure						
Meals out & fast foods	\$b	2.4	4.1	6.7	9.6	14.9
Meat, fish & seafood	\$b	1.7	2.3	3.1	3.5	4.5
Fruit & vegetables	\$b	1.6	2.2	2.8	3.2	4.2
Condiments, confectionery etc.	\$b	1.3	1.8	2.4	2.9	3.5
Bakery products, flour & cereals	\$b	1.1	1.5	1.8	2.2	2.7
Non-alcoholic beverages	\$b	0.7	1.0	1.5	1.7	2.1
Dairy products	\$b	0.9	1.2	1.4	1.7	2.0
Other food	\$b	0.8	1.2	1.6	2.2	2.8
Total food	\$b	10.6	15.3	21.2	27.0	36.4
Excluding meals out & fast foods	\$b	8.2	11.3	14.6	17.4	21.6
Share of total						
Meals out & fast foods	%	22.4	26.5	31.3	35.6	40.8
Meat, fish & seafood	%	16.4	15.3	14.7	13.0	12.2
Fruit & vegetables	%	15.5	14.6	13.0	12.0	11.4
Condiments, confectionery etc.	%	12.6	12.0	11.4	10.6	9.5
Bakery products, flour & cereals	%	10.2	9.6	8.5	8.2	7.4
Non-alcoholic beverages	%	7.0	6.8	7.0	6.2	5.7
Dairy products	%	8.0	7.7	6.7	6.1	5.4
Other food	%	7.8	7.5	7.5	8.2	7.6
Total food	%	100.0	100.0	100.0	100.0	100.0
Excluding meals out & fast foods	%	77.6	73.5	68.7	64.4	59.2

Note: Current prices. Food includes non-alcoholic beverages; fruit includes nuts; dairy products includes milk; condiments, confectionery etc. includes food additives and prepared meals. Each quintile comprises 20% of households based on gross household income where, for example, quintile 1 is the lowest 20% of households. Source: ABS 2017a

Expenditure on food types in 2015-16, by net worth quintile

Australia's household expenditure on the eight main food types in 2015-16 in each of the five net worth quintiles is presented in Figure 15. There is a significant revealed preference toward spending on meals out and fast foods in all net worth quintiles—in 2015-16, expenditure per person on meals out and fast foods ranged from \$1198 (32 per cent of total food) in net worth quintile 1 to \$2207 (38 per cent) in net worth quintile 5 (Figure 15a, Table 13).

Except for other food, average expenditure per person on each food type increases consistently with net worth quintile; that is, food expenditure per person is consistently lowest in net worth quintile 1 and highest in net worth quintile 5 (except for other food).

Figure 15 Australia's household food expenditure, by food type and net worth quintile, 2015-16



a) Average expenditure per person



b) Total expenditure

Note: Current prices. Food includes non-alcoholic beverages. Condiments, confectionery etc. includes food additives and prepared meals. Each quintile comprises 20% of the estimated population based on household net worth where quintile 1 is the lowest 20% and quintile 5 is the highest 20% of households. Source: ABS 2017a Total food expenditure for each food type tends to increase with net worth quintile—the other food category is the main exception to this general expenditure pattern (Figure 15b, Table 13). Except for meals out and fast foods, and the other food category, the distribution of expenditure on most food types is much more closely aligned across net worth quintiles compared with the distribution across income quintiles.

		Gross household net worth quintile				
Variable	Unit	1	2	3	4	5
Average food expenditure per person						
Meals out & fast foods	\$	1,198	1,408	1,499	1,643	2,207
Meat, fish & seafood	\$	486	540	645	745	808
Fruit & vegetables	\$	433	485	595	670	790
Condiments, confectionery etc.	\$	438	464	531	543	566
Bakery products, flour & cereals	\$	310	341	400	453	464
Non-alcoholic beverages	\$	270	286	296	319	325
Dairy products	\$	242	277	300	334	347
Other food	\$	371	393	370	296	378
Total food	\$	3,748	4,194	4,635	5,004	5,886
Excluding meals out & fast foods	\$	2,550	2,786	3,136	3,361	3,679
Total food expenditure						
Meals out & fast foods	\$b	4.8	6.8	6.7	7.9	11.3
Meat, fish & seafood	\$b	2.0	2.6	2.9	3.6	4.1
Fruit & vegetables	\$b	1.7	2.4	2.7	3.2	4.0
Condiments, confectionery etc.	\$b	1.8	2.3	2.4	2.6	2.9
Bakery products, flour & cereals	\$b	1.3	1.7	1.8	2.2	2.4
Non-alcoholic beverages	\$b	1.1	1.4	1.3	1.5	1.7
Dairy products	\$b	1.0	1.3	1.3	1.6	1.8
Other food	\$b	1.5	1.9	1.7	1.4	1.9
Total food	\$b	15.1	20.4	20.8	24.0	30.1
Excluding meals out & fast foods	\$b	10.3	13.5	14.1	16.1	18.8
Share of total						
Meals out & fast foods	%	32.0	33.6	32.3	32.8	37.5
Meat, fish & seafood	%	13.0	12.9	13.9	14.9	13.7
Fruit & vegetables	%	11.6	11.6	12.8	13.4	13.4
Condiments, confectionery etc.	%	11.7	11.1	11.4	10.9	9.6
Bakery products, flour & cereals	%	8.3	8.1	8.6	9.1	7.9
Non-alcoholic beverages	%	7.2	6.8	6.4	6.4	5.5
Dairy products	%	6.5	6.6	6.5	6.7	5.9
Other food	%	9.9	9.4	8.0	5.9	6.4
Total food	%	100.0	100.0	100.0	100.0	100.0
Excluding meals out & fast foods	%	68.0	66.4	67.7	67.2	62.5

Table 13 Household food expenditure, by food type and net worth quintile, 2015-16

Note: Current prices. Food includes non-alcoholic beverages; fruit includes nuts; dairy products includes milk; condiments, confectionery etc. includes food additives and prepared meals. Each quintile comprises 20% of households based on household net worth where, for example, quintile 1 is the lowest 20% of households. Source: ABS 2017a

Expenditure on food types in 2015-16, by age category

Australia's household expenditure on the eight main food types in 2015-16 in each of the seven age categories is presented in Figure 16. There is a significant revealed preference toward spending on meals out and fast foods in all age categories—this is most pronounced in the two youngest age categories and the 55-64 years group, and least pronounced in the 75 years plus group. In 2015-16, expenditure per person on meals out and fast foods ranged from \$911 (22 per cent of total food) in the 75 years plus group to \$1917 (42 per cent) in in the 25-34 years group (Figure 16a, Table 14).

Except for meals out and fast food and other food, average expenditure per person tends to increase with age category up to the 55-64 years group (highest in one food type) or 65-74 years group (highest in five food types). The 15-24 years group has the highest average food expenditure per person on other food.

Figure 16 Australia's household food expenditure, by food type and age category, 2015-16







Note: Current prices. Food includes non-alcoholic beverages. Condiments, confectionery etc. includes food additives and prepared meals. Age category is based on the age of the household reference person. Source: ABS 2017a
These expenditure patterns are broadly consistent with increasing demand for higher quality food products in older age categories supported by household asset accumulation—in 2015-16, average household net worth per person increased steadily across the first six age categories, from \$56,000 in the 15-24 years group to \$673,000 in the 65-74 years group, before declining slightly to \$641,000 in the 75 plus years group (Table 9). In aggregate, the four age categories between 25 and 64 years account for over three-quarters of total expenditure (Figure 16b).

Other food accounted for 12 per cent of total food expenditure per person in the lowest age category, and between 9 and 10 per cent in the second youngest age category and the two lowest net worth quintiles (8 per cent in all households). The other food share, which includes eggs and egg products, edible oils and fats and food not elsewhere classified, has more than doubled since 1988-89 (Table 11; ABS 2017a). Given the increasing importance of other food, it may be useful for the ABS to consider providing more data on this category in the next HES.

Variable	Unit	15-24 vears	25-34 vears	35-44 vears	45-54 vears	55-64 vears	65-74 vears	75 plus vears
Average food expenditure per person	ome	ycars	ycars	ycars	y cars	ycai s	years	ycars
Meals out & fast foods	\$	1 9 1 2	1 917	1 3 7 5	1 664	1 901	1 4 1 3	911
Meat fish & seafood	φ \$	443	470	548	686	835	861	695
Fruit & vogetables	φ \$	422	490	515	586	737	812	721
Condimonts confectionery atc	ф Ф	422	490	484	540	580	542	514
Bakery products flour & coreals	ф Ф	267	305	376	412	458	470	455
Non alcoholic houerages	¢ ¢	207	277	251	222	245	247	706
Non-acconone beverages	ф Ф	250	277	231	323	251	271	200
Other feed	¢	250	425	2/4	297	260	3/1	344
	ф Ф	300	455	545	3/0	500	205 F 101	4 1 4 7
	¢	4,629	4,592	4,167	4,887	5,575	5,101	4,147
Excluding meals out & fast foods	\$	2,/1/	2,675	2,792	3,223	3,674	3,688	3,236
l otal food expenditure	¢1	1.0		7.0	0.1			
Meals out & fast foods	\$b	1.2	7.6	7.8	9.1	7.1	3.3	1.4
Meat, fish & seafood	\$b	0.3	1.8	3.1	3.8	3.1	2.0	1.0
Fruit & vegetables	\$b	0.3	1.9	2.9	3.2	2.7	1.9	1.1
Condiments, confectionery etc.	\$b	0.3	1.7	2.8	3.0	2.2	1.3	0.8
Bakery products, flour & cereals	\$b	0.2	1.2	2.1	2.3	1.7	1.1	0.7
Non-alcoholic beverages	\$b	0.2	1.1	1.4	1.8	1.3	0.8	0.4
Dairy products	\$b	0.2	1.0	1.6	1.6	1.3	0.9	0.5
Other food	\$b	0.4	1.7	2.0	2.1	1.4	0.7	0.3
Total food	\$b	2.9	18.1	23.7	26.8	20.7	11.9	6.2
Excluding meals out & fast foods	\$b	1.7	10.5	15.9	17.7	13.7	8.6	4.9
Share of total								
Meals out & fast foods	%	41.3	41.7	33.0	34.1	34.1	27.7	22.0
Meat, fish & seafood	%	9.6	10.2	13.1	14.0	15.0	16.9	16.8
Fruit & vegetables	%	9.1	10.7	12.4	12.0	13.2	15.9	17.4
Condiments, confectionery etc.	%	9.3	9.5	11.6	11.1	10.4	10.6	12.4
Bakery products, flour & cereals	%	5.8	6.6	9.0	8.5	8.2	9.2	11.0
Non-alcoholic beverages	%	7.4	6.0	6.0	6.6	6.2	6.8	6.9
Dairy products	%	5.4	5.7	6.6	6.1	6.3	7.3	8.3
Other food	%	12.2	9.5	8.3	7.7	6.6	5.5	5.3
Total food	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Excluding meals out & fast foods	%	58.7	58.3	67.0	65.9	65.9	72.3	78.0

Table 14 Household food expenditure, by food type and age category, 2015-16

Note: Current prices. Food includes non-alcoholic beverages; fruit includes nuts; dairy products includes milk;

condiments, confectionery etc. includes food additives and prepared meals.

Source: ABS 2017a

Expenditure on food types in 2015-16, by source of income

Australia's household expenditure on the eight main food types in 2015-16 in government payment households (where government pensions and allowances are the main source of income) and three private income categories is presented in Figure 17. Notably, average expenditure per person on meals out and fast foods in government payment households is well below that in each of the private income groups (Figure 17, Table 15). On average, in 2015-16, expenditure per person on meals out and fast foods was \$679 in government payment households, accounting for 19 per cent of total food expenditure in this group, and \$1812 in private income households, accounting for 36 per cent of total food expenditure.

Figure 17 Australia's household food expenditure, by food type & main source of income, 2015-16



a) Average expenditure per person



b) Total expenditure

Note: Current prices. Food includes non-alcoholic beverages. Condiments, confectionery etc. includes food additives and prepared meals. Each quintile comprises 20% of the estimated population based on gross household income where quintile 1 is the lowest 20% and quintile 5 is the highest 20% of households. Source: ABS 2017a Table 15 Household food expenditure, by food type and main source of income, 2015-16

		C		Private income Employee income Own business Other income 1,819 1,503 1,926 635 701 873 582 664 851 515 511 550 394 401 468 309 299 324 294 309 387 409 293 292 4,956 4,679 5,671 3,137 3,177 3,745 29,4 1.6 3.7 10.3 0.7 1.7 9,4 0.7 1.6			
Variable	Unit	pensions & allowances	Employee income	Own business	Other income	Total	
Average food expenditure per perso	n						
Meals out & fast foods	\$	679	1,819	1,503	1,926	1,812	
Meat, fish & seafood	\$	595	635	701	873	662	
Fruit & vegetables	\$	550	582	664	851	613	
Condiments, confectionery etc.	\$	480	515	511	550	518	
Bakery products, flour & cereals	\$	377	394	401	468	401	
Non-alcoholic beverages	\$	260	309	299	324	309	
Dairy products	\$	298	294	309	387	303	
Other food	\$	263	409	293	292	394	
Total food	\$	3,503	4,956	4,679	5,671	5,012	
Excluding meals out & fast foods	\$	2,824	3,137	3,177	3,745	3,200	
Total food expenditure							
Meals out & fast foods	\$b	2.8	29.4	1.6	3.7	34.6	
Meat, fish & seafood	\$b	2.5	10.3	0.7	1.7	12.6	
Fruit & vegetables	\$b	2.3	9.4	0.7	1.6	11.7	
Condiments, confectionery etc.	\$b	2.0	8.3	0.5	1.1	9.9	
Bakery products, flour & cereals	\$b	1.6	6.4	0.4	0.9	7.7	
Non-alcoholic beverages	\$b	1.1	5.0	0.3	0.6	5.9	
Dairy products	\$b	1.2	4.7	0.3	0.7	5.8	
Other food	\$b	1.1	6.6	0.3	0.6	7.5	
Total food	\$b	14.6	80.0	4.8	10.8	95.7	
Excluding meals out & fast foods	\$b	11.8	50.7	3.3	7.2	61.1	
Share of total							
Meals out & fast foods	%	19.4	36.7	32.1	34.0	36.1	
Meat, fish & seafood	%	17.0	12.8	15.0	15.4	13.2	
Fruit & vegetables	%	15.7	11.7	14.2	15.0	12.2	
Condiments, confectionery etc.	%	13.7	10.4	10.9	9.7	10.3	
Bakery products, flour & cereals	%	10.8	7.9	8.6	8.3	8.0	
Non-alcoholic beverages	%	7.4	6.2	6.4	5.7	6.2	
Dairy products	%	8.5	5.9	6.6	6.8	6.0	
Other food	%	7.5	8.3	6.3	5.2	7.9	
Total food	%	100.0	100.0	100.0	100.0	100.0	
Excluding meals out & fast foods	%	80.6	63.3	67.9	66.0	63.9	

Note: Current prices. Food includes non-alcoholic beverages; fruit includes nuts; dairy products includes milk; condiments, confectionery etc. includes food additives and prepared meals. Own business is own unincorporated business income.

Source: ABS 2017a

5 Economic implications for food producers

The introduction to this report posed a question relating to economic opportunities for food producers: are there significant population sub-groups where there is a revealed preference, at least on average, to pay more for food products and/or services with reliable quality attributes? This chapter briefly examines supply-side implications of trends in household food expenditure.

Australia's household food requirements

Recent trends

Economic opportunities for Australia's food producers—farmers and food processors—have been significantly enhanced in recent decades (Figure 18, Table 16).

- **Expanded domestic food market**—Australia's household food requirements have increased over time; between 1988-89 and 2015-16, on average, food expenditure increased by 0.9 per cent a year on a per person basis and 2.5 per cent a year in aggregate (chapter 3).
- More diversified domestic food supply chain—there are increased opportunities to sell • food to the food services industry because of the increasing importance of meals out and fast foods in household food consumption; between 1988-89 and 2015-16, the share of meals out and fast foods in food expenditure increased from 25 per cent to 34 per cent (chapter 4).

Figure 18 Australia's household food expenditure, by major food group, 1988-89 to 2015-16



Note: Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages. Sources: ABS 2017a,b

The main focus in this chapter is on household food expenditure patterns in the most recent period. Growth rates for food expenditure over the period 2009-10 to 2015-16 varied significantly between the two major food categories.

- **Meals out and fast foods**—on average, expenditure increased by 1.7 per cent a year on a per person basis and 3.0 per cent a year in total.
- **Food excluding meals out and fast foods**—on average, expenditure fell by 0.7 per cent a year on a per person basis and increased by 0.6 per cent a year in total; expenditure per person fell for all food types except other food.
- **Food**—overall, food expenditure increased by 0.1 per cent a year on a per person basis and 1.3 per cent a year in total.

Table 16 Household food expenditure, by food type, 1988-89 to 2015-16: growth rates

Variable/food type	1988-89 to 1998-99	1998-99 to 2009-10	2009-10 to 2015-16	1988-89 to 2015-16
	%	%	%	%
Population and income				
No. households	2.8	1.5	1.1	1.9
No. persons	2.1	1.4	1.3	1.6
After-tax income per person	1.2	3.5	0.5	2.0
Average food expenditure per person				
Meals out & fast foods	1.5	2.8	1.7	2.1
Meat, fish & seafood	-2.0	1.3	-0.9	-0.5
Fruit & vegetables	0.2	1.2	-0.1	0.6
Condiments, confectionery etc.	3.0	0.8	-0.4	1.3
Bakery products, flour & cereals	1.2	-0.2	-2.8	-0.3
Non-alcoholic beverages	0.9	-0.8	-3.4	-0.8
Dairy products	1.1	0.3	-2.3	0.0
Other food	1.4	4.8	6.2	3.8
Total food	0.7	1.4	0.1	0.9
Food excluding meals out & fast foods	0.5	0.8	-0.7	0.4
Total food expenditure				
Meals out & fast foods	3.6	4.3	3.0	3.7
Meat, fish & seafood	0.0	2.7	0.3	1.2
Fruit & vegetables	2.3	2.7	1.2	2.2
Condiments, confectionery etc.	5.1	2.2	0.8	3.0
Bakery products, flour & cereals	3.3	1.2	-1.6	1.3
Non-alcoholic beverages	3.0	0.6	-2.2	0.9
Dairy products	3.2	1.8	-1.1	1.6
Other food	3.5	6.2	7.5	5.5
Total food	2.8	2.8	1.3	2.5
Food excluding meals out & fast foods	2.6	2.2	0.6	2.0

Note: Average annual growth rates; based on values in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages; fruit includes nuts; dairy products includes milk; condiments, confectionery etc. includes food additives and prepared meals.

Sources: ABS 2017a,b (and previous issues)

There are two key aspects of food demand that are important in considering future economic opportunities for the supply-side of the market.

- **Food energy requirements of the individual**—ideally, each individual consumes adequate food to meet daily energy needs; although there are limits to food energy requirements (for example, based on calorific content), there may be significant variation in food demand depending on, for example, the extent of physical activity and age of the individual.
- **Food nutrition requirements of the individual**—ideally, each individual consumes adequate food across the core food groups (discussed further in chapter 6); on average, household expenditure patterns across food types other than meals out and fast foods have been relatively consistent over time, indicating food consumption is spread across food types (see Figure 13).

Population growth is therefore a fundamental influence on changes in Australia's household food requirements both in aggregate and across the core food groups. As noted in chapter 2, food demand growth is also influenced by changes in consumer incomes, real food prices and the tastes and preferences of individuals (including lifestyle factors). Notably, the food type, meals out and fast foods, is a substitute for other food types that are purchased for home preparation; in this case, increased expenditure on meals out and fast foods would result in reduced expenditure on other food types (all else constant).

In recent years, movements in real food prices and the real prices of meals out and fast foods have diverged (Figure 19). Growth rates for the volume of food purchased between 2009-10 and 2015-16 are estimated as follows (average annual growth rates, some rounding error).

- **Meals out and fast foods**—the volume of food purchased increased strongly by 3.0 per cent a year (calculated as the expenditure growth rate for meals out and fast foods, 3.0 per cent, minus the growth rate for real prices, 0.0 per cent).
- **Food excluding meals out and fast foods**—the volume of food purchased increased moderately by 1.8 per cent a year (expenditure 0.6 per cent, real prices -1.3 per cent).
- **Food**—the volume of food purchased increased by 2.2 per cent a year (expenditure 1.3 per cent, real prices -0.8 per cent), well above the population growth rate of 1.3 per cent a year.



Figure 19 Real food price indexes, total and meals out & fast foods, 1988-89 to 2016-17

Note: Consumer price index in the food category divided by the all groups consumer price index, rebased to 1988-89=100; that is, CPI-adjusted data. Food includes non-alcoholic beverages. Source: ABS 2017b Growth estimates for the volume of food consumption should be interpreted with caution and may indicate there has been some switching toward higher-priced food products and services.

Key drivers of food demand, 2009-10 to 2015-16

A key finding from an analysis of HES data is that changes in tastes and preferences (including lifestyle factors) were the most important driver of increased demand for meals out and fast foods in recent years. The results of the simplified analysis of the key drivers of food demand growth between 2009-10 and 2015-16, using the approach outlined in chapter 2, is presented in Table 17 for total food and the two major food categories.

The results for total food are broadly consistent with the findings based on ABS national accounts data (given in Table 3). Over the period 2009-10 to 2015-16, the main influences on food demand growth are population growth (accounting for 59 per cent of the total increase in the estimated volume of food purchased), followed by changes in tastes and preferences (17 per cent), lower real food prices (13 per cent) and higher after-tax income per person (12 per cent).

For simplicity, the influence of population growth and real income growth on food demand growth is assumed to be the same for the two major food categories (the same income elasticity of demand is used for each category)—that is, 1.6 percentage points of food demand growth in each category is due to these two factors. The responsiveness of demand to changes in real food prices is assumed to be the same for each major food category (that is, the same price elasticity of demand is used), but the impact differs because real food prices, on average, were unchanged for meals out and fast foods (no price impact on food demand growth), and fell for food excluding meals out and fast foods (contributing 0.4 percentage points to food demand growth). Based on the residual term, changes in tastes and preferences explained nearly half the demand growth for meals out and fast foods, and had a marginally negative impact on food demand growth for food excluding meals out and fast foods.

		Meals out	Food excluding meals out	
Variable	Unit	& fast foods	& fast foods	Total food
Food demand				
Food expenditure (in 2015-16 prices)	%	3.0	0.6	1.3
Real food prices	%	0.0	-1.3	-0.8
Volume of food purchased	%	3.0	1.8	2.2
Key influences - percentage point contra	ibution to food d	emand		
Population	% points	1.3	1.3	1.3
Income	% points	0.3	0.3	0.3
Price	% points	0.0	0.4	0.3
Other (tastes and preferences)	% points	1.4	-0.1	0.4
Sum of above	% points	3.0	1.8	2.2
Key influences - percentage contributio	n to food deman	d		
Population	%	42.8	69.4	58.5
Income	%	8.9	14.4	12.1
Price	%	0.0	22.4	12.5
Other (tastes and preferences)	%	48.3	-6.2	16.9
Sum of above	%	100.0	100.0	100.0

Table 17 Key influences on Australia's food demand, by major food group, 2009-10 to 2015-16

Note: Average annual growth rate for food demand variables. Key variables are based on HES data: volume of food purchased (food demand); number of persons (population); after-tax income tax per person (income); real food prices (price).

Sources: Based on data in ABS 2017a,b; Muhammad et al 2011

Spending more on meals out and fast foods is broadly based

Economic opportunities for Australia's food producers associated with a more diversified domestic food supply chain are broadly based. This is important because it covers a wide range of market segments including, for example, low-income households where price is likely to be the key driver of food choices, and high-income households where other factors are likely to have a significant influence on food choices.

The relationship between food expenditure per person and the share spent on meals out and fast foods is given in Figure 20 for each of the four key population sub-groups in 2009-10 and 2015-16. For income groups, the frontier mainly shifted up in 2015-16, implying a consistent increase in the meals out and fast foods share (Figure 20a). For net worth groups, the frontier also shifted up and there was a significant adjustment in spending patterns in net worth quintile 2 (the meals out and fast foods share for quintile 2 remained above those for quintiles 3 and 4; Figure 20b). For population sub-groups based on age category, the frontier also shifted up; notably, the S-shaped frontier indicates significant differences in outcomes through the lifecycle.

Figure 20 Food expenditure per person vs. meals out & fast foods share, by population sub-group, 2009-10 and 2015-16



Note: Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages. Expenditure per person on meals out and fast foods as a % of food expenditure per person in the same category. **d**) Government payments are the main income source.

Sources: ABS 2017a,b

For government payment households, food expenditure per person in 2009-10 and 2015-16 was relatively low. However, it is likely that, on average, income saved in 2015-16 through spending less on a given quantity of food excluding meals out and fast foods (due to a real price fall) was used to supplement spending on meals out and fast foods. The meals out and fast foods share in this group increased from 17.5 per cent in 2009-10 to 19.4 per cent in 2015-16.

A snapshot of total food expenditure and the meals out and fast food share across the four key population sub-groups in 2009-10 and 2015-16 is presented in Figure 21. Compared with the outcome in Figure 20, the frontier in Figure 21 takes into account the number of persons within a category in 2009-10 and population growth over the period 2009-10 to 2015-16. This enables food producers, or participants in the domestic supply chain more broadly, at a glance, to identify market segments according to size of food expenditure, relative importance of meals out and fast foods, and growth over the seven-year period. Average annual growth rates over the period 2009-10 to 2015-16 for key variables across the three main population sub-groups are provided in appendix D.

Figure 21 Total food expenditure vs. meals out & fast foods share, by population sub-group, 2009-10 and 2015-16



Note: Values are in 2015-16 prices; CPI-adjusted data. Food includes non-alcoholic beverages. Meals out and fast foods expenditure as a % of total food expenditure in the same category. **d)** Government payments are the main income source. Sources: ABS 2017a,b

Australia's food price-quality spectrum

Implied food price-quality relationships in 2015-16

A simple analysis of HES data is undertaken to identify population sub-groups that are highly likely, on average, to demand higher-quality food; that is, to identify market segments where there is likely to have been a demonstrated willingness to pay a price premium for higher-quality food. HES food expenditure data are used to estimate implied price-quality relationships across three population sub-groups: gross household income (income quintiles), household net worth (net worth quintiles) and age of the household reference person (age categories); the population sub-group where government pensions and allowances are the main source of household income is discussed further in chapter 6 from a food security perspective.

One of the key concerns about the interpretation of the volume growth estimates for household food consumption is that there is a limit to the quantity of food that any individual may consume in a given time period. If the quantity of food purchased and consumed by individuals is the same, on average, across population sub-groups, the food price ratio may be approximated by the food expenditure ratio (see Box 1 and appendix E for further information). For simplicity, the benchmark food price is assumed to be the Australian average food price; the benchmark price ratio is equal to 1.

The population sub-groups are divided into three categories based on the assumption that a 5 per cent divergence from the benchmark price ratio is significant.

- **Food price discount**—market segments where the average food price is 5 per cent or more below the benchmark price include income quintiles 1, 2 and 3, net worth quintiles 1 and 2, and age categories 35-44 years and 75 plus years.
- **Average food prices**—key market segments where the average food price is within 5 per cent of the benchmark price include income quintile 4, net worth quintile 3 and age categories 15-24 years, 25-34 years and 45-54 years.
- **Food price premium**—market segments where the average food price is 5 per cent or more above the benchmark price include income quintile 5, net worth quintiles 4 and 5, and age categories 55-64 years and 65-74 years.

The food expenditure ratio in 2015-16 is presented in Figure 22 for each of the main food types and population sub-groups.

- **Income quintile**—the food expenditure ratio pattern is similar for all main food types except for meals out and fast foods and, to a lesser extent, other food. Since there are strong substitution possibilities between meals out and fast food and all other main food types, the expenditure ratio for each main food type is not likely to be a reliable indicator of the corresponding price ratio (see Box 1 for further discussion of this issue).
- Net worth quintile—the food expenditure ratio pattern is similar for all main food types except for other food. Average food expenditure per person consistently increases across the net worth quintiles for all main food types except other food. The increase in the expenditure ratio is somewhat more pronounced for meals out and fast foods (range across quintiles is 63 percentage points), meat, fish and seafood (50 percentage points), and fruit and vegetables (59 percentage points). Of the three population sub-groups, the expenditure ratios for the main food types except other food, based on net worth quintile, are likely to be the most reliable indicators of the corresponding price ratio.

Box 1 Simple algebraic relationships between food expenditure and food prices

This box derives simple algebraic relationships between food expenditure and food prices. For simplicity, assume there are two people who spend different amounts on food in a given year. Person one is a low-income earner and person two is a high-income earner. Food expenditure by the low-income earner, denoted by E_{LY} , is lower than food expenditure by the high-income earner, E_{HY} ; that is:

Assume it is possible to quantify the amount of food purchased (for example, based on energy content or calorific value). Food expenditure is equal to the unit price of food, P, multiplied by the quantity of food purchased, Q (that is, $E=P \times Q$). Substituting this relationship into equation (1) gives:

(2)
$$P_{LY} \times Q_{LY} < P_{HY} \times Q_{HY}$$

Assuming each person consumes the same quantity of food such that Q_{LY}=Q_{HY}, equation (2) becomes:

$$(3) P_{LY} < P_{HY}$$

That is, for a given quantity of food, person 2 pays a higher unit price for food compared with person 1.

Food expenditure per person on food types

In practice, people consume food across a range of food groups (for example, consuming food across the essential food groups to meet minimum nutrition requirements). Since there are substantial substitution possibilities between meals out and fast foods and other main food types, the quantity of food consumed in a main food type may vary as well as price. This aspect may be examined further by assuming each person purchases a mix of two food commodities with prices P₁ and P₂. For the low-income earner, food expenditure is the sum of expenditure on the two food commodities:

(4)
$$E_{LY} = P_{LY} \times Q_{LY} = P_1 \times Q_{LY,1} + P_2 \times Q_{LY,2}$$

where $Q_{LY}=Q_{LY,1}+Q_{LY,2}$. An expression for the unit price of food, P_{LY} , may be derived by dividing by Q_{LY} :

(5)
$$P_{LY} = P_1 \times Q_{LY,1} / Q_{LY} + P_2 \times Q_{LY,2} / Q_{LY} = a_{LY,1} \times P_1 + a_{LY,2} \times P_2$$

where the weights are the quantity shares, defined as $a_{LY,1}=Q_{LY,1}/Q_{LY}$ and $a_{LY,2}=Q_{LY,2}/Q_{LY}$ (0< $a_{LY,1}$, $a_{LY,2}$ =1). That is, the unit price of food purchased by person 1 is the weighted sum of the price of the two individual food commodities. Corresponding relationships also apply for the high-income earner. Substituting equation (5) and the corresponding equation for the high-income earner into equation (3) gives:

(6)
$$a_{LY,1} \times P_1 + a_{LY,2} \times P_2 < a_{HY,1} \times P_1 + a_{HY,2} \times P_2$$

It can be demonstrated that, with $P_2>P_1$, the high-income earner purchases relatively more of the higher-priced food commodity 2 compared with the low-income earner; that is, $a_{HY,1}<a_{LY,1}$ and $a_{LY,2}<a_{HY,2}$ (derived using $a_{LY,1}=1-a_{LY,2}$ and $a_{HY,1}=1-a_{HY,2}$, in equation (6) and rearranging terms). These relationships may also represent a single food type where there are two food quality options such that the higher quality food sells at a price premium (based on the assumption the quantity purchased or consumed is the same for each person).

Food price relationships in HES population sub-groups

To examine economic opportunities for food producers, HES data for population sub-groups may be used to derive food prices relative to a benchmark price, assumed for simplicity to be the average unit food price for all households in Australia (denoted by the subscript Aus). If the average quantity of food consumed per person is the same for all categories in a population sub-group (that is, $Q_i = Q_{Aus}$ for each category i), it follows that $E_i/P_i=E_{Aus}/P_{Aus}$ and therefore $P_i/P_{Aus}=E_i/E_{Aus}$. Food price options are:

(7a)	If $E_i / E_{Aus} < 1$,	$P_i / P_{Aus} < 1$	food price discount on average in category i					
(7b)	If $E_i / E_{Aus} = 1$,	$P_i / P_{Aus} = 1$	benchmark food price on average in category i					
(7c)	If $E_i / E_{Aus} > 1$,	$P_i / P_{Aus} > 1$	food price premium on average in category i					
Equations (7a) to (7c) are the implied price-quality relationships across population sub-groups.								

Figure 22 Expenditure per person, % Australian average in the same food type, by population sub-group, 2015-16



a) By income quintile









Note: Expenditure per person as a % of the Australian average in the same food type (that is, for each food type, equal to E_i/E_{Aus} in equations 7a, 7b and 7c in Box 1 where subscripts i and Aus denote population-sub-group and Australia, respectively). Food excludes alcoholic beverages. Each quintile comprises 20% of households based on gross household income or household net worth where, for example, quintile 1 is the lowest 20% of households. Source: ABS 2017a

	Gross household income quintile								
Food type	1	2	3	4	5	Range			
	%	%	%	%	%	% points			
Meals out & fast foods	57	64	85	105	150	93			
Meat, fish & seafood	103	92	98	95	111	19			
Fruit & vegetables	105	95	94	94	112	18			
Condiments, confectionery etc.	100	92	97	99	109	18			
Bakery products, flour & cereals	105	94	93	98	110	17			
Non-alcoholic beverages	96	88	101	98	112	23			
Dairy products	108	99	96	96	105	12			
Other food	86	80	88	106	122	43			
Total food	86	82	92	100	125	42			
Food excluding meals out & fast foods	101	92	95	97	112	20			

Table 18 Expenditure per person, % all households, by food type & income quintile, 2015-16

Note: Expenditure per person as a % of the Australian average in the same food type. Food excludes alcoholic beverages. Range is a measure of spread, calculated as the difference between the maximum and minimum percentages for the food type.

Source: ABS 2017a

Table 19 Expenditure per person, % all households, by food type & net worth quintile, 2015-16

	Gross household net worth quintile								
Food type	1	2	3	4	5	Range			
	%	%	%	%	%	% points			
Meals out & fast foods	74	88	93	102	137	63			
Meat, fish & seafood	75	83	99	115	124	50			
Fruit & vegetables	72	81	99	111	131	59			
Condiments, confectionery etc.	86	91	104	106	111	25			
Bakery products, flour & cereals	78	86	101	114	117	39			
Non-alcoholic beverages	90	95	99	106	108	18			
Dairy products	80	92	99	111	115	35			
Other food	101	107	100	81	103	26			
Total food	79	89	98	106	124	45			
Food excluding meals out & fast foods	81	89	100	107	118	36			

Note: Expenditure per person as a % of the Australian average in the same food type. Food excludes alcoholic beverages. Source: ABS 2017a

Table 20	Expenditure	per person	. % all	households.	bv	food typ	e &	age category	. 2015-16
	LAPEHUILUIE	per person,	, <i>i</i> u an	nousenoius,	юγ	τουατγρ	COL	age categor	<i>, 2013-10</i>

Food type	15-24 years	25–34 years	35-44 years	45–54 years	55–64 years	65–74 years	75 plus years	Range
	%	%	%	%	%	%	%	% points
Meals out & fast foods	119	119	85	103	118	88	57	63
Meat, fish & seafood	68	72	84	106	128	133	107	64
Fruit & vegetables	70	81	86	97	123	135	120	65
Condiments, confectionery etc.	84	85	95	106	113	106	101	30
Bakery products, flour & cereals	67	77	95	104	115	118	114	51
Non-alcoholic beverages	114	92	84	108	115	116	95	32
Dairy products	83	86	91	98	116	123	114	40
Other food	154	118	94	103	100	77	60	94
Total food	98	97	88	103	118	108	87	30
Food excluding meals out & fast foods	87	85	89	103	117	118	103	32

Note: Expenditure per person as a % of the Australian average in the same food type. Food excludes alcoholic beverages. Source: ABS 2017a

• **Age category**—the food expenditure ratio pattern highlights the influence of the life cycle where, notably, the 45-54 years category is closest to the benchmark outcome for most food types, and the two youngest age categories spend relatively more on three food types compared with the Australian benchmark (other food, meals out and fast foods, non-alcoholic beverages).

In practice, the quantity of food purchased and consumed by individuals may not be the same, on average, across population sub-groups for a number of reasons. Energy requirements vary between people; this is most likely to result in different average outcomes based on age category. Food may also be consumed by family, friends and neighbours, and/or donated to community events such as school fetes. Food waste also creates a wedge between the quantity of food purchased and consumed by individuals; that is, not all food purchased is consumed. Overall, however, relatively high food expenditure per person in a particular category is likely to indicate, at least to some extent, a willingness to pay a price premium for quality attributes of the food product and/or service. Reliability is an important influence on the willingness of consumers to pay a price premium for food quality (see, for example, Box 2).

Food labelling

Food labelling is the main investment option to provide consumers with information about the attributes of a food product (see, for example, Hogan 2017 and Hogan and Morey 2014). Given the importance of meals out and fast foods in Australia's household food consumption, there may be a useful role for government to consider cost-effective options that extend food labelling to the food services industry (discussed further in chapter 6).

In general terms, product attributes may be grouped into three categories according to how they may be verified by the consumer, if at all (see, for example, Karl and Orwat 1999).

- **Search**—product attributes may be checked by searching the product before purchase (for example, by looking at or feeling the product).
- **Experience**—product attributes may be checked after the product is consumed or experienced (allowing consumers to learn through experience and adjust their spending patterns accordingly; see Box 2).
- **Credence**—claims about product attributes may not be reasonably checked by consumers at all, even after consumption (for example, food origin such as wild caught or farmed fish/seafood from Australia or elsewhere).

Three types of product labels are typically defined that vary according to the approach used to signal information to consumers, particularly on credence attributes.

- **Type I labels are criteria based, third-party certification programs**—these labels signal to consumers that criteria, which define a minimum quality level, have been met with verification by a reputable independent organisation; this includes, for example, the Heart Foundation tick, organic certification, the FAIRTRADE mark and the dolphin-safe tuna label.
- **Type II labels are information self-declaration programs**—these labels rely on the reputation of the business.
- **Type III labels are quantified product information label programs, using preset indices**—these labels are report cards that provide more information to consumers about specific attributes of the product; this includes, for example, food nutrition labels, and healthy star rating labels on food.

Box 2 Illustrative economic effects of food quality reliability

This box briefly examines market outcomes based on different assumptions relating to the reliability of the quality of a food commodity. This illustrative economic analysis relates to the experience attributes of a food commodity and therefore provides relatively more detail on the demand-side of the market. For simplicity, the food commodity is assumed to be a non-traded good (that is, there are no international exports or imports), and the interaction of domestic supply and demand conditions determine the market price.

Assume there are two quality options for the food commodity—good and poor—which, for simplicity, may be a 1 kilogram bag of a fresh fruit or vegetable.

- **100% good quality**—all food achieves the quality the consumer requires (for example, a juicy lemon).
- **Mix of good quality and poor quality**—for example, 75% of the food achieves the quality the consumer requires; the remaining 25% represents losses to the consumer (for example, a dry lemon).

The consumer is not able to identify food quality by observation (that is, it is not a search attribute); instead, food quality is only identified when the consumer uses the food (for example, cuts the lemon open).

In the absence of risk, the consumer knows with certainty the quality of the food commodity; in practice, this is similar to an assessment based on reliable or consistent outcomes from previous purchases over an extended period of time (the seller has established a reputation for food quality). If the consumer knows the bag contains 100% good quality food, the market outcome is described by the intersection of the supply curve, S_0 , and the demand curve, D_0 , where the total quantity of food, Q_0 , is sold for price, P_0 (see box figure); that is, the market equilibrium occurs where the marginal cost of production (the supply curve) is equal to the marginal benefit of consumption (the demand curve). Alternatively, if the consumer knows the bag contains 75% good quality food, the demand curve shifts down (for example, to D_{RN}) and a lower total quantity of food, Q_{RN} , is sold at a lower price, P_{RN} (for simplicity, the supply curve, S_0 , is unchanged).

Now consider the more realistic situation where the consumer does not know with certainty the quality of the food commodity. If the consumer is risk neutral, the willingness to pay is based on the expected quality mix (based on experience; equal to the probability weighted sum of possible outcomes). If the bag, on average, contains 75% good quality food, the market outcome will be similar to the corresponding certain case where food quantity, Q_{RN}, is sold at price, P_{RN}. However, if the consumer is risk averse, the willingness to pay is discounted further because the consumer is relatively more concerned about unexpected losses (a higher share of poor quality food) than the possibility of unexpected gains (a higher share of good quality food). In this case, the demand curve shifts to D_{RA}, and a lower food quantity, Q_{RA}, is sold at a lower price, P_{RA}.

These definitions of risk neutrality and risk aversion correspond to the certainty equivalent approach used to assess risky investment decisions. In this box, the consumption decision is treated as a 'mini-investment' in the sense that the food commodity is intended to provide a flow of services over the time period in which it is consumed. The food commodity is not considered an essential food.



Figure: Illustrative market impact of food price-quality options, non-traded good

Illustrative projections to 2049-50

Australia's future food demand growth will be underpinned by population growth. Based on ABS population projections, between 2016-17 and 2049-50, Australia's resident population is projected to increase, on average, by 1.6 per cent a year in the high case (Series A), 1.3 per cent a year in the medium case (Series B) and 1.0 per cent a year in the low case (Series C) (ABS 2013). Using medium case population projections and three assumptions for average annual growth in food expenditure per person (1.0, 0.5 and 0.0 per cent), between 2016-17 and 2049-50, Australia's household food consumption expenditure increases from \$92 billion to \$194 billion in the high case, \$165 billion in the medium case and \$140 billion in the low case (Figure 23a).

A key uncertainty in the outlook period is the extent to which the broadly-based trend toward spending more on meals out and fast foods will continue. Using HES data and medium case projections, household food expenditure increases from \$110 billion in 2015-16 to \$202 billion in 2016-17, comprising an increase from \$37 billion to \$69 billion for meals out and fast foods (assumes a constant share of total food expenditure), and \$73 billion to \$134 billion for all other food (Figure 23b).





a) National accounts data

b) Household expenditure survey data (medium case: 1.8% growth rate)



Note: Values are in 2015-16 prices; CPI-adjusted data. Illustrative projections are based on ABS population projections for Series B (medium case). **a)** Average annual growth rate for population (1.3%) plus household food consumption expenditure per person (0.0%, 0.5%, 1.0%). **b)** Average annual growth rate for household food expenditure per person is 0.5%. Constant share for meals out and fast foods from 2015-16 (34 per cent). Sources: ABS 2017b,c,d, 2014, 2013

6 Issues

This chapter briefly examines food security in Australian households where government pensions and allowances are the main source of income, nutrition security, and food losses and waste.

Food security

One of the most important roles of government is to ensure the food security of the population. In general terms, food security refers to the adequate and reliable provision of food that is safe, nutritious and affordable (Box 3). As a net exporter of food and food technology services, Australia contributes significantly to global food security (see, for example, Hogan and Morris 2010 and PMSEIC 2010).

One important mechanism in the Australian Government's policy framework that contributes significantly to Australia's high level of food security is income support to low-income households through transfer payments. Other important aspects of the policy framework, discussed in chapter 5 of Hogan (2017), include the exemption of fresh food in the goods and services tax (GST), and information and education programs (such as food labelling, the provision of healthy food in school canteens, and access to reliable information on healthy lifestyle choices covering food in a balanced diet and exercise).

Box 3 Definitions of food security

FAO (2012) distinguishes between food security and nutrition security.

- **Food security** 'exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life' (FAO 2012, p. 57).
- **Nutrition security** is a related concept that 'exists when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, in order to ensure a healthy and active life for all household members. Nutrition security differs from food security in that it also considers aspects of adequate caring practices, health and hygiene in addition to dietary adequacy' (FAO 2012, p. 57).

Food security may be examined at the global, national, regional and household level. For example, FAO (2012) defines household food security as the application of the food security concept to the family level, with individuals within households the focus of concern. Goodall (2009) defines food security in five contexts.

- **Global food security**—production and distribution of sufficient food to meet fundamental nutritional requirements around the world.
- **National food security**—a nation's ability to meet domestic food demand.
- **Household food security**—a household or community's ability to access food (particularly healthy food), given physical and income constraints.
- Emergency food security—continuity of food supply in the face of sudden disruptions.
- **Future food security**—given resource constraints and the threat of impacts from climate change, sustainable production of sufficient food to meet domestic and global food demands in the future.

The World Bank (2007) highlights three key aspects of food security—food availability (producing enough to eat), food access (having enough to eat) and food use (ending hidden hunger). Food use translates food security into nutrition security, and is also linked to water access and sanitation.

Food insecurity is mainly a problem in developing countries—in 2014-16, 775 million people or 13 per cent of the total population in low and middle income countries were unable to access sufficient food to meet their daily minimum dietary energy requirements (see table 8.1 in FAO 2017, p. 77). In high-income countries, food insecurity was an issue for 23 million people or 1.6 per cent of the total population in 2014-16 (FAO 2017).

1,500

Food security in Australia's government payment households

The introduction to this report posed a question relating to food security in Australia: is there a reasonable level of food security, based on average food expenditure per person, in each population sub-group? This section focuses on households where government pensions and allowances are the main source of income.

Based on HES data, the number of people in government payment households increased sharply from 2.7 million in 1988-89 to 4.2 million in 1993-94, largely as a result of the economic recession in the early 1990s and the associated increase in Australia's unemployment rate, and has remained close to this level since that time; the unemployment rate, seasonally adjusted, increased from 5.8 per cent in December 1989 to a high of 11.2 per cent in December 1992, and has since declined overall to 5.5 per cent in December 2017 (ABS 2018b). The number of people in government payment households has represented a declining share of the total population since 1993-94; the share increased from 18 per cent in 1988-89 to 24 per cent in 1993-94, but has since declined back to 18 per cent in 2015-16.

In government payment households, food expenditure per person increased from \$3130 in 1988-89 to \$3514 in 2009-10, before falling marginally to \$3503 in 2015-16, an overall average growth rate of 0.4 per cent a year (in 2015-16 prices; see also Figure 20, Figure 21 and the associated text in chapter 5). A comparison of food expenditure patterns in government payment households and all households in 2015-16 is presented in Figure 24.

Figure 24 Food expenditure patterns, government payment households & all households, 2015-16



a) Average food expenditure per person



Note: In 2015-16 prices. Condiments, confectionery etc. includes food additives & prepared meals. Source: 2017a

An important objective in the Australian Government's income transfer system is to provide adequate food security for people in government payment households. There are two key indicators of food security in government payment households.

- **Share of income spent on food**—food security in government payment households has been enhanced, at least on average, to the extent there has been a significant fall in the share of household income spent on food, from 29 per cent in 1988-89 to 21 per cent in 2009-10 and 19 per cent in 2015-16.
- **Food expenditure per person as a share of the Australian average**—the main difference in food expenditure patterns in government payment households compared with the average Australian household is spending on meals out and fast foods (where recent strong growth in the general population has been largely discretionary). For example, in 2015-16, expenditure per person in government payment households, as a share of the corresponding Australian average, was 74 per cent for total food, 42 per cent for meals out and fast foods, and 90 per cent for food excluding meals out and fast foods (Table 21).

More information on government pension and allowance recipients is available for 2009-10 from ABS (2011). Potential areas of concern relate to households reliant on family support payments (1.6 million persons in 2009-10) and households reliant on unemployment and study payments (0.9 million persons). In 2009-10, expenditure per person in households reliant on family support payments, as a share of the corresponding Australian average, was 53 per cent for total food, 27 per cent for meals out and fast foods, and 67 per cent for all other food. Expenditure per person in households reliant on unemployment and study payments, as a share of the corresponding Australian average, was 62 per cent for total food, 37 per cent for meals out and fast foods, and 75 per cent for all other food. These households may require significant complementary support from family, friends, neighbours and/or non-government organisations.

Low-income households may acquire additional food support through, for example, food pantries, meals on wheels, and meals with family or friends (the US experience is examined in a recent USDA study, Todd and Scharadin 2016; see also Tiehen et al 2017). Food rescue organisations are discussed briefly in Australian Government Department of the Environment and Energy (2017) (as an option to mitigate food waste while alleviating food insecurity, food banks are examined in a case study in FAO 2014).

	Exper	nditure per p	erson	Total expenditure					
	Growth	% all hou	iseholds	Growth	% all hou	iseholds			
Variable	rate	2009-10	2015-16	rate	2009-10	2015-16			
	%	%	%	%	%	%			
Meals out & fast foods	1.6	42	42	1.1	8	8			
Meat, fish & seafood	-0.9	91	92	-1.4	18	16			
Fruit & vegetables	0.5	88	91	0.0	18	16			
Condiments, confectionery etc.	0.8	87	94	0.2	17	17			
Bakery products, flour & cereals	-2.4	92	95	-2.9	18	17			
Non-alcoholic beverages	-1.3	76	87	-1.8	15	16			
Dairy products	-1.6	94	98	-2.2	19	18			
Other food	2.1	91	72	1.5	18	13			
Total food	-0.1	74	74	-0.6	15	13			
Excluding meals out & fast foods	-0.4	89	90	-1.0	18	16			

Table 21 Food expenditure in government payment households, 1988-89 to 2015-16

Note: Average annual growth rate, based on 2015-16 prices; CPI-adjusted data. % of the corresponding average in all households. Food includes non-alcoholic beverages.

Source: ABS 2017a,b and previous issues

Nutrition security

Globally, there has been a significant focus on the role of nutrition in food security and health outcomes (see, for example, FAO 2017, FAO et al 2017, HLPE 2017). For example, the United Nations Decade of Action on Nutrition (2016–2025) was declared by the UN General Assembly in April 2016 (FAO and WHO 2016). The aim is to encourage policy action to address all forms of malnutrition. The release in 2017 of the report, *The State of food security and nutrition in the world*, commences regular monitoring of global progress toward achieving food security and nutrition targets (FAO et al 2017).

Food systems

HLPE (2017) examines the impact of food systems on dietary patterns and nutritional outcomes, and policies that have the potential to improve nutrition and enhance food security. The report has a specific focus on nutrition and health outcomes of food systems, identifying the following three elements of food systems as entry and exit points for nutrition (see HLPE 2017, pp. 11-13).

- **Food supply chain**—encompasses all activities that move food from production to consumption, including production, storage, distribution, processing, packaging, retailing and marketing; decisions by supply chain participants influence the types of food available and accessible, and the way food is produced and consumed.
- **Food environment**—refers to the overall setting in which consumers engage with the food system to acquire, prepare and consume food; key elements that influence food choices, food acceptability and diets are: physical and economic access to food (proximity and affordability); food promotion, advertising and information; and food quality and safety.
- **Consumer behaviour**—reflects the choices made by consumers, at the household or individual level, on what food to acquire, store, prepare and eat; consumer behaviour is influenced by personal preferences determined by taste, convenience, culture and other factors, but is also shaped by the existing food environment.

HLPE (2017) examines traditional, mixed and modern food systems, where modern food systems are characterised by: more diverse food options throughout the year; processing and packaging to extend the shelf life of food; consumer access to detailed information on food labels, store shelves, and menus; food advertising; food safety that is monitored and enforced; and storage and transport infrastructures (including cold chain) that are generally prevalent and reliable. Modern food systems include both formal and easily accessible markets in high-income areas, and food deserts and food swamps in low-income areas.

- **Food deserts**—geographic areas where residents' access to food is restricted or nonexistent due to the absence or low density of "food entry points" within a practical travelling distance (food entry points are the physical spaces where food is obtained).
- **Food swamps**—areas where there is an overabundance of "unhealthy" foods, but little access to "healthy" foods.

HLPE (2017) also notes the cost of staples is lower relative to animal source food and perishable foods, while specialty foods (such as organic food) are more expensive.

Malnutrition

Although definitions vary slightly, malnutrition is defined by WHO (2016) to cover two broad groups of conditions—undernutrition and overnutrition (see also HLPE 2017).

- **Undernutrition**—includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies (inadequate intake of important vitamins and minerals such as Vitamin A, iron and iodine).
- **Overnutrition**—includes overweight, obesity and diet-related non-communicable diseases (such as heart disease, stroke, diabetes and cancer).

Nearly one-third of the global population suffers from at least one form of malnutrition (WHO 2017). In 2014, there were around 462 million adults (18 years and older) who were underweight, and 1.9 billion adults who were overweight or obese. In 2016, for children under the age of five, around 155 million were stunted (chronically undernourished) and a further 52 million were wasted (acutely undernourished), while around 41 million were overweight or obese. Undernutrition accounts for around 45 per cent of deaths among children under five. In addition, for example, 264 million women of reproductive age are affected by iron-amenable anaemia.

As outlined in HLPE (2017), Vitamin A deficiency is the leading cause of preventable blindness in children and increases the risk of disease and death from infections, iron-deficient anaemia may lead to low cognition and work productivity, and iodine deficiency during pregnancy can compromise children's mental health and even survival. Other important deficiencies are Vitamin D, B12, folate, calcium and zinc.

Malnutrition affects the entire life cycle and its effects can extend across generations. Some groups are particularly vulnerable to malnutrition, including those with specific nutrient requirements at critical stages of their life cycle (such as young children, adolescent girls, pregnant and lactating women, the elderly and people who are ill are immuno-compromised) or marginalized groups that have less control over their diets (such as the urban and rural poor, as well as some indigenous peoples). Malnutrition during the first 1 000 days of life increases the risk of morbidity and mortality and limits children's mental and physical growth to levels far below their full genetic potential, having important consequences for their whole life. (HLPE 2017, para. 15, p. 13)

Policy implications

All forms of malnutrition may coexist within a country, but modern food systems are associated with lower levels of undernutrition—including deficiencies in macronutrients (proteins, carbohydrate and fats) and micronutrients (vitamins and minerals)—and higher levels of overweight and obesity and diet-related non-communicable diseases (FAO et al 2017, HLPE 2017).

In modern food systems, policy-makers should focus on encouraging the availability and accessibility of diverse and healthy diets, particularly for the marginalized and the most vulnerable. They should aim to limit the consumption of highly-processed and nutrient-poor foods by targeting the industries that produce them (e.g. through marketing restrictions, content restrictions and labelling requirements for trans fats and added sugars) as well as consumers (e.g. through subsidies and taxes; nutrition education). Such policies could mitigate some of the negative health consequences generally associated with modern food systems. (HLPE 2017, para. 35, p. 16)

As noted at the beginning of this chapter, key features of the Australian Government's policy framework underpinning Australia's relatively high level of food security were outlined in Hogan (2017), including income support to low-income households through transfer payments, the exemption of fresh food in the goods and services tax (GST), and information and education programs (such as food labelling, the provision of healthy food in school canteens, and access to reliable information on healthy lifestyle choices covering food in a balanced diet and exercise).

Information policies

Information policies complement Australia's tax-transfer system by allowing people to be better informed about the health implications of food and lifestyle choices given their individual circumstances. For example, as noted in Hogan (2017), the Australian Government Department of Health has a website with guidelines on healthy lifestyle choices for various population groups, including information on nutrition and physical activity (Box 4).

Given increasing concerns about recent nutrition trends in high-income countries, as outlined in major international reports such as HLPE (2017) and FAO et al (2017), there may be a useful role for the Australian government to consider providing consumers with more nuanced and accessible information about food choices. In particular, with broad information about trade-offs between health risks and diet/lifestyle options, there may be a greater willingness for people to make incremental changes to food and lifestyle choices, given their individual circumstances, that improve health risks and outcomes (discussed further in appendix F).

Given the importance of meals out and fast foods in food consumption, there may also be a useful role for government to consider cost-effective food labelling options for the food services industry (see chapter 5). Food labelling applied to meals out and fast foods may encourage people to make healthy food choices by providing consumers with information about food attributes such as nutrition content (for example, a healthy star rating system; see Dunford et al 2017) and food origin (for example, origin labelling for wild caught and farmed fish/seafood).

Box 4 Australian Government guidelines for healthy lifestyle choices

Australia currently has a range of guidelines and recommendations for various population groups regarding physical activity, sedentary behaviour, and healthy eating. In the Australian guide to healthy eating, the advice to people is to drink plenty of water and adopt a diet that largely comprises the following five food groups.

- grain (cereal) foods, mostly wholegrain and/or high cereal fibre varieties
- vegetables and legumes/beans
- lean meats and poultry, fish, eggs, tofu, nuts and seeds and legumes/beans
- milk, yoghurt, cheese and/or alternatives, mostly reduced fat
- fruit.

Australia's physical activity guidelines for adults (18-64 years), for example, include the following.

- doing any physical activity is better than doing none. If you currently do no physical activity, start by doing some, and gradually build up to the recommended amount
- be active on most, preferably all, days every week
- accumulate 150 to 300 minutes (2 ½ to 5 hours) of moderate intensity physical activity or 75 to 150 minutes (1 ¼ to 2 ½ hours) of vigorous intensity physical activity, or an equivalent combination of both moderate and vigorous activities, each week
- do muscle strengthening activities on at least 2 days each week

Sources: Australian Government Department of Health (http://www.healthyactive.gov.au/internet/healthyactive/publishing.nsf/Content/recommendationsguidelines); see also National Health and Medical Research Council 2013

Food losses and waste

HLPE (2014, see p. 22) examined global food losses and waste, including food quality loss or waste, from a food security and nutrition perspective using the following definitions.

- **Food losses**—the decrease, at all stages of the food chain prior to the consumer level, in mass, of food that was originally intended for human consumption, regardless of the cause.
- **Food waste**—food appropriate for human consumption being discarded or left to spoil at the consumer level, regardless of the cause.
- **Food quality loss or waste**—the decrease in a quality attribute of food (such as nutrition), linked to the degradation of the product, at all stages of the food chain from harvest to consumption.

Global food losses and waste account for around one-third of food produced for human consumption (FAO 2011). The distribution of food losses and waste along the food chain varies across regions and food products. Notably, food waste at the consumption stage tends to be relatively high in high-income countries (and households). For example, in North America and Oceania (includes Australia), 32 per cent of initial food production is estimated to have been lost or wasted: 10.5 per cent at the harvest stage; 9.3 per cent at the postharvest, processing and packing, and distribution stages; and 12.6 per cent at the consumption stage (HLPE 2014, elaborated from estimates in FAO 2011).

In Australia, the five main food categories in household food waste are: fruit and vegetables; leftovers from meals out and fast foods; meat and fish; rice, pasta and bread; and dairy products (Baker et al 2009).

The causes of food losses and waste in medium/high-income countries mainly relate to consumer behaviour as well as to a lack of coordination between different actors in the supply chain. Farmer-buyer sales agreements may contribute to quantities of farm crops being wasted. Food can be wasted due to quality standards, which reject food items not perfect in shape or appearance. At the consumer level, insufficient purchase planning and expiring 'best-beforedates' also cause large amounts of waste, in combination with the careless attitude of those consumers who can afford to waste food.

Food waste in industrialized countries can be reduced by raising awareness among food industries, retailers and consumers. There is a need to find good and beneficial use for safe food that is presently thrown away. (FAO 2011, p. v)

While there may be significant scope to reduce food waste and losses, particularly through developing new food markets and products, 'pursuing the absolute goal of zero food wastage is unrealistic and economically inefficient, due to high marginal costs' (FAO 2014, p. 50). Seven case studies of various food wastage mitigation measures are examined in FAO (2014) including, for example, the Australian experience with using food waste as pig feed.

Possibly a key message from the level of household food waste is that intended consumption of healthy food, as indicated by food purchases, should be more consistently followed through with actual consumption. Eating most, if not all, of the healthy food already purchased—particularly fruit and vegetables, meat and seafood, and dairy products—is likely to significantly enhance nutrition security by reducing the risk of insufficient consumption of healthy food options (nutrition gaps) and possibly also reducing the risk of excessive consumption of discretionary food options (see appendix F).

Australia's National Food Waste Strategy

Australia's *National Food Waste Strategy*, launched in November 2017, aims to halve food waste by 2030 (Australian Government Department of the Environment and Energy 2017, p. 29).

To achieve success in the four areas of policy support, business improvements, market development, and behaviour change, all Australians will need to contribute to and adopt an integrated approach where we:

- collaborate to achieve common or coinciding goals
- innovate to find new solutions and change the way we do things
- share knowledge and data so we are better informed to make decisions.

Governments can assist by facilitating communication and collaboration between those involved in the food system. They can increase community awareness of food waste, share data and knowledge, encourage innovation and continuous improvement, and incentivise action. They can also assess regulations to ensure they support food waste reduction and are not inadvertently causing impediments to dealing with food waste. The Australian Government can support actions in areas where national consistency and harmonisation of approaches is needed.

The Strategy presents a framework to support policy options to reduce food waste.

Investment in research and development

Research and development (R&D), particularly basic research, is a key activity where there tends to be significant underinvestment by private markets compared with the socially optimal level. In 2014-15, the latest year for which data are available, rural R&D expenditure in Australia was \$3.1 billion, comprising \$1.7 billion on agriculture, fisheries and forestry, \$0.4 billion on sustainable production, \$0.2 billion on agricultural inputs and \$0.7 billion on rural processing (Table 22). The public and private sectors contributed almost equally to rural R&D expenditure, although R&D expenditure on rural processing was largely sourced from the private sector.

R&D investment in rural processing has mainly been regarded as applied R&D and therefore more within the scope of the private sector. However, there may be a useful role for the Australian Government to consider further support for R&D into new food products and/or food processing technologies that, if adopted or used in follow-up applied research, would provide the food product and services industry with potential future economic opportunities to utilise food that is currently lost or wasted in the food system. An example of current research at CSIRO that aims to reduce food losses is presented in Box 5.

Category	Agriculture, fisheries and forestry		Sustainable production		Agriculture inputs		Rural processing		Total	
	Value	% total	Value	% total	Value	% total	Value	% total	Value	% total
	\$m	%	\$m	%	\$m	%	\$m	%	\$m	%
Public sector	1,106	64	346	84	41	22	93	12	1,588	52
Private sector	616	36	64	16	142	78	651	87	1,473	48
Total	1,723	100	410	100	183	100	745	100	3,061	100

Table	22	Rural	research	and	development	expenditure	in	Australia.	hv	sector.	2014	-15
Iable	~~	Nurai	research	anu	development	expenditure		Australia,	IJУ	sector,	2014	-13

Note: Current prices; values are rounded to the nearest \$ million. See source report for further information. Source: Based on Millist et al 2017

Box 5 R&D case study: CSIRO research on converting food waste to nutritious food

The challenge: reversing wasteful processes

When apples are used for juicing, around a third of an apple's biomass (apple pomace or pulp) is left after the production process. The apple pomace is currently discarded or used in low-value animal feed or compost, although it is edible and highly nutritious (contains polyphenols, dietary fibres, protein and essential nutrients).

CSIRO response: stabilising apple ingredients

Researchers from CSIRO's Food Innovation Centre have developed a method to return lost food-grade biomass into the food supply as value-added ingredients and food products. Using apple pomace as a model food source, CSIRO developed a process for stabilising apple pomace to prevent its physical, chemical and microbial degradation. This creates a nutritious and functional ingredient that retains its flavour, nutritional values and complies with food safety regulations. This process can also be applied to other fruits, vegetables and horticulture products, such as broccoli, carrots, tomatoes, peach, olives and grapes.

The results: tasty and nutritious food

The stabilised wet pomace can be used as a raw material for the extraction of high value bioactive components for nutraceuticals or supplements. The whole pomace can also be transformed into a shelf-stable, nutritious, functional ingredients in different formats for use in many different food applications. For example, the stabilised wet pomace can be converted into paste, powder, flake, granule or pellet and used as an ingredient or component in manufacture of different food products. Powders can be used in smoothies, desserts, yoghurts, sauces and jams, bakery and extruded products. Flakes, granules or pellets can be used as components in breakfast cereals and health bars.

Source: CSIRO 2018

7 Conclusion

This report has presented updated estimates of household food expenditure trends. Between 2009-10 and 2016-17, the key drivers of Australia's household food demand growth were, in order of importance, population growth, changes in tastes and preferences (including lifestyle choices), lower real food prices and real income growth. There are a number of notable features of recent trends in Australia's food market.

- **Demand-side of the food market**—while population growth is important because each person should consume sufficient food to meet energy and nutrition requirements, there has been a further broadly-based shift toward spending on meals out and fast foods; the share of meals out and fast foods in household food expenditure in Australia increased from 31 per cent in 2009-10 to 34 per cent in 2015-16.
- **Supply-side of the food market**—domestic households are still the most important market (based on value), but food exports have recovered strongly in recent years, from \$25 billion in 2009-10 to \$39 billion in 2016-17 (in 2015-16 prices); the share of exports in Australia's indicative food production increased from a recent low of 25 per cent in 2009-10 to 33 per cent in 2016-17.

In terms of the two key questions posed in the introduction to this report, some comments are as follows.

- **Food security**—based on average outcomes in population sub-groups in 2015-16 using HES data, the Australian Government's transfer system is important in ensuring a high level of food security across households in Australia; some households, such as those highly reliant on family support payments, may require complementary support (for example, from family, friends, neighbours and non-government organisations). In lower income and/or net worth households where price is likely to be the key driver of food demand, the food industry may continue to explore options to provide households with greater access to nutritious food at low prices (including consideration of food access in 'food swamps' and 'food deserts').
- **Economic opportunities in the domestic food supply chain**—future food demand growth in Australia will be underpinned by population growth; a key uncertainty in the outlook is the extent to which changing tastes and preferences (including lifestyle factors) toward meals out and fast foods will continue to be a key driver of food demand growth. For people living in higher income and/or net worth households, there is a demonstrated willingness to pay a premium for quality attributes of food products and services, including convenience factors. As outlined in Hogan (2017), food labelling is a key approach to inform consumers about quality attributes that may earn a price premium.

A key challenge in the long-term trend toward increased demand for meals out and fast foods is to ensure people have information about food attributes such as nutrition content. There may also be a useful role for the Australian government to provide consumers with more nuanced and accessible information about the health implications of food choices and lifestyle options to allow people to make incremental choices that lower the risk of adverse health outcomes, taking into account their individual circumstances (including tastes and preferences). Reliable food product and service labelling may enhance nutrition security in Australia, and allow consumers to make food choices that, for a given price, are more closely aligned with their tastes and preferences, reducing food waste (all else constant).

Appendix A: Definitions of food expenditure and related measures

ABS national accounts

Several key national accounts measures of food consumption and related variables, presented in chapters 2 and 4, are defined as follows (ABS 2017c).

Gross domestic product (GDP): The total market value of goods and services produced in Australia within a given period after deducting the cost of goods and services used up in the process of production but before deducting allowances for the consumption of fixed capital. It is equivalent to gross national expenditure plus exports of goods and services less imports of goods and services.

Gross value added: The value of output at basic prices minus the value of intermediate consumption at purchasers' prices. The term is used to describe gross product by industry and by sector. Basic prices valuation of output removes the distortion caused by variations in the incidence of commodity taxes and subsidies across the output of individual industries.

Gross income – households: The total income, whether in cash or kind, receivable by persons normally resident in Australia. It includes both income in return for productive activity (such as compensation of employees, the gross mixed income of unincorporated enterprises, gross operating surplus on dwellings owned by persons, and property income receivable, etc.) as well as transfers receivable (such as social assistance benefits and non-life insurance claims).

Net worth In the national and sectoral balance sheets, net worth represents the difference between the stock of assets (both financial and non-financial) and the stock of liabilities (including shares and other equity). Because it is derived residually, it can be negative.

Final consumption expenditure – households: Net expenditure on goods and services by persons and expenditure of a current nature by private non-profit institutions serving households. This item excludes expenditures by unincorporated businesses and expenditures on assets by non-profit institutions (included in gross fixed capital formation). Also excluded is expenditure on maintenance of dwellings (treated as intermediate expenses of private enterprises), but personal expenditure on motor vehicles and other durable goods and the imputed rent of owner-occupied dwellings are included. The value of 'backyard' production (including food produced and consumed on farms) is included in household final consumption expenditure and the payment of wages and salaries in kind (e.g. food and lodging supplied free to employees) is counted in both household income and household final consumption expenditure.

Current prices: Estimates are valued at the prices of the period to which the observation relates. For example, estimates for this financial year are valued using this financial year's prices. This contrasts to chain volume measures where the prices used in valuation refer to the prices of the previous year.

Chain volume measure: Annually-reweighted chain Laspeyres volume indexes referenced to the current price values in a chosen reference year (i.e. the year when the quarterly chain volume measures sum to the current price annual values). Chain Laspeyres volume measures are compiled by linking together (compounding) movements in volumes, calculated using the average prices of the previous financial year, and applying the compounded movements to the current price estimates of the reference year. Quarterly chain volume estimates are benchmarked to annual chain volume estimates, so that the quarterly estimates for a financial year sum to the corresponding annual estimate.

Implicit price deflator (IPD): Obtained by dividing a current price value by its real counterpart (the chain volume measure). When calculated from the major national accounting aggregates, such as gross domestic product, implicit price deflators relate to a broader range of goods and services in the economy than that represented by any of the individual price indexes that are published by the ABS. Movements in an implicit price deflator reflect both changes in price and changes in the composition of the aggregate for which the deflator is calculated.

Reference period: For price or volume indexes, the reference period means the period to which the indexes relate. It is typically set equal to 100 for price indexes and to the corresponding current price values of the reference year for volume indexes, and it does not necessarily coincide with the base period.

ABS household expenditure survey (HES)

Household expenditure survey measures of expenditure and related variables, presented in chapters 3 and 5, are defined as follows (ABS 2011).

Household: A person living alone or a group of related or unrelated people who usually live in the same private dwelling.

Expenditure: The cost of goods and services acquired during the reference period for private use, whether or not the goods were paid for or consumed. Expenditure is net of refunds. Expenditure is classified according to the Household Expenditure Classification which contains over 600 detailed items.

Income: Income consists of all current receipts, whether monetary or in kind, that are received by the household or by individual members of the household, and which are available for, or intended to support, current consumption. Income includes receipts from:

- wages and salaries and other receipts from employment (whether from an employer or own incorporated enterprise)
- profit/loss from own unincorporated business (including partnerships)
- net investment income (interest, rent, dividends, royalties)
- government pensions and allowances
- private transfers (e.g. superannuation, workers' compensation, income from annuities, child support, and financial support received from family members living in another household).

Gross income is the sum of the income from all these sources before income tax, the Medicare levy and the Medicare levy surcharge are deducted.

Government pensions and allowances: Income support payments from government to persons under social security and related government programs. Included are pensions and allowances received by aged, disabled, unemployed and sick persons, families and children, veterans or their survivors, and study allowances for students. All overseas pensions and benefits are included here, although some may not be paid by overseas governments. Family Tax Benefit, Baby Bonus and Child Disability Assistance Payment paid to recipients of Carer Allowance are also included in government pensions and allowances.

Net worth: Net worth is the value of a household's assets less the value of its liabilities. Net worth may be negative when household liabilities exceed household assets.

Reference person: The reference person for each household is chosen by applying, to all household members aged 15 years and over, selection criteria, until a single appropriate reference person is identified.

Quintiles: Groupings that result from ranking all households or persons in the population in ascending order according to some characteristic (e.g. household income) and then dividing the population into five equal groups, each comprising 20% of the estimated population.

Appendix B: Value of Australia's food market in 2016-17

Table B1 Value of Australia's food trade, by category, 2016-17

		Exports		Imp	orts	Net exports		
Category	U/P	Value	% total	Value	% total	Value	Net importer	
		\$m	%	\$m	%	\$m	×	
Livestock-based food								
Live animals except fish	U	1293	3.3	1	0.0	1292		
Meat								
Meat processing	Р	11080	28.1	654	4.5	10426		
Poultry processing	Р	56	0.1	0	0.0	56		
Bacon, ham and smallgoods	Р	120	0.3	191	1.3	-71	×	
Total	Р	11256	28.6	845	5.9	10411		
Dairy								
Milk and cream processing	Р	1107	2.8	176	1.2	931		
Ice cream	Р	13	0.0	73	0.5	-61	×	
Other dairy products	Р	1078	2.7	1007	7.0	72		
Total	Р	2198	5.6	1256	8.7	942		
Total livestock-based food	U/P	14747	37.4	2102	14.6	12645		
Fisheries-based food								
Fish or shellfish	U	1024	2.6	73	0.5	950		
Seafood	Р	279	0.7	1881	13.0	-1602	×	
Total fisheries-based food	U/P	1303	3.3	1954	13.6	-651	×	
Crops-based food								
Fruit and vegetables								
Unprocessed	U	1525	3.9	591	4.1	934		
Processed	Р	1015	2.6	2320	16.1	-1305	×	
Total fruit and vegetables	U/P	2540	6.4	2911	20.2	-371	×	
Other crops-based food								
Grains and oilseeds	U	10812	27.5	84	0.6	10728		
Sugar	Р	2277	5.8	101	0.7	2176		
Oil and fat	Р	401	1.0	678	4.7	-277	×	
Flour mill and cereal food	Р	1497	3.8	1105	7.7	392		
Bakery products	Р	178	0.5	727	5.0	-549	×	
Confectionery	Р	276	0.7	848	5.9	-572	×	
Soft drink, cordial and syrup	Р	120	0.3	960	6.7	-840	×	
Other food								
Unprocessed	U	78	0.2	475	3.3	-397	×	
Processed	Р	5155	13.1	2477	17.2	2678		
Total other food	U/P	5233	13.3	2952	20.5	2281		
Total other crops-based food	U/P	20793	52.8	7455	51.7	13338		
Total crops-based food	U/P	23332	59.2	10365	71.9	12967		
Total food								
Unprocessed	U	14731	37.4	1225	8.5	13506		
Processed	Р	24651	62.6	13197	91.5	11454		
Total food	U/P	39382	100.0	14422	100.0	24960		

Note: In current prices. Total food excludes alcoholic beverages (beer and malt, wine, spirit). U=unprocessed (minimally transformed food); P=processed (substantially or elaborately transformed food). Value of net exports is value of exports minus value of imports; a negative sign indicates Australia is a net importer of the food product. Grains and sugar data are ABARES estimates where ABS confidentiality restrictions apply. Oil and fat, and other food categories are included in cropbased food by assumption.

Source: ABARES 2017

Appendix C: Household income and expenditure, by data source

Figure C1 Overview of Australia's household income account, 1988-89 to 2016-17



Note: Based on ABS national accounts data. In 2015-16 prices; CPI-adjusted data. Food excludes alcoholic beverages. Summary data are given in Table 1 and Table 2. Sources: ABS 2017b,c

Figure C2 Food expenditure share of after-tax income, by data source, 1988-89 to 2016-17



Note: Household food consumption expenditure as a share of household income after income tax. Food excludes alcoholic beverages. Sources: ABS 2017a,b,c Figure C3 Household income and expenditure measures, by data source, 1988-89 to 2016-17



a) Household income after income tax

Note: In 2015-16 prices; CPI-adjusted data. Food excludes alcoholic beverages. Sources: ABS 2017a,b,c

Appendix D: Food expenditure growth rates, 2009-10 to 2015-16

By income quintile

Over the period 2009-10 to 2015-16, the revealed preference for spending more on meals out and fast foods, at least on average, was evident in all income groups (Table D1). In most other cases, expenditure per person fell over the period (exceptions were fruit and vegetables in income quintiles 2 and 3, condiments, confectionery etc. in income quintile 1, and other food). Total food expenditure increased in all income groups; the growth rate for total food expenditure tends to increase with income group, ranging from 0.6 per cent a year on average in the two lowest income quintiles to 1.8 per cent in income quintile 5.

Table D1 Food expenditure, by food type & income quintile, 2009-10 to 2015-16: growth rates

	Gross household income quintile							
Variable	1	2	3	4	5			
	%	%	%	%	%			
Population and income								
No. households	1.0	1.2	1.1	1.1	1.1			
No. persons	0.5	0.4	1.5	1.8	1.5			
After-tax income per person	2.0	1.6	0.2	0.0	0.3			
Household net worth per person	0.6	2.7	1.1	1.4	0.6			
Average food expenditure per person								
Meals out & fast foods	2.3	2.6	1.0	1.4	1.6			
Meat, fish & seafood	-1.1	-0.7	-0.4	-1.3	-1.0			
Fruit & vegetables	-0.8	1.0	0.4	-0.6	-0.1			
Condiments, confectionery etc.	0.5	-0.4	-0.3	-1.3	-0.2			
Bakery products, flour & cereals	-2.9	-2.7	-2.8	-3.3	-2.5			
Non-alcoholic beverages	-1.0	-2.9	-2.5	-4.7	-4.1			
Dairy products	-2.0	-1.4	-2.4	-2.8	-2.5			
Other food	5.2	1.9	3.4	9.1	8.2			
Total food	0.0	0.2	-0.1	-0.2	0.3			
Excluding meals out & fast foods	-0.6	-0.6	-0.6	-1.0	-0.5			
Total food expenditure								
Meals out & fast foods	2.9	3.1	2.6	3.2	3.1			
Meat, fish & seafood	-0.5	-0.2	1.1	0.5	0.4			
Fruit & vegetables	-0.2	1.4	1.9	1.2	1.3			
Condiments, confectionery etc.	1.0	0.1	1.2	0.5	1.3			
Bakery products, flour & cereals	-2.3	-2.2	-1.3	-1.5	-1.0			
Non-alcoholic beverages	-0.4	-2.4	-1.0	-3.0	-2.7			
Dairy products	-1.5	-0.9	-0.9	-1.0	-1.1			
Other food	5.8	2.3	5.0	11.0	9.7			
Total food	0.6	0.6	1.4	1.6	1.8			
Excluding meals out & fast foods	-0.1	-0.2	0.9	0.8	1.0			

Note: Average annual growth rate between 2009-10 and 2015-16, based on values in 2015-16 prices. Food includes nonalcoholic beverages. Each quintile comprises 20% of households based on gross household income where, for example, quintile 1 is the lowest 20% of households.

Sources: ABS 2017a,b, 2011

By net worth quintile

Over the period 2009-10 to 2015-16, food expenditure per person increased in all net worth quintiles except net worth quintile 2 (this group experienced falls in after-tax income per person and net worth per person, Table D2). The revealed preference for spending more on meals out and fast foods, at least on average, was evident in all net worth quintiles except net worth quintile 2. In nearly all other cases, expenditure per person fell over the period (exceptions were fruit and vegetables in net worth quintiles 1 and 3, condiments, confectionery etc. in net worth quintile 1, and other food).

Taking into account population growth, total food expenditure increased in all net worth groups; the growth rate for total food expenditure ranges from 0.9 per cent a year on average in net worth quintile 3 to 1.8 per cent in net worth quintile 5.

	Gross household net worth quintile							
Variable	1	2	3	4	5			
	%	%	%	%	%			
Population and income								
No. households	1.1	1.1	1.1	1.1	1.0			
No. persons	0.5	2.2	0.8	1.3	1.4			
After-tax income per person	1.1	-0.7	0.6	1.3	0.3			
Household net worth per person	2.0	-0.2	1.5	2.6	0.2			
Average food expenditure per person								
Meals out & fast foods	2.0	-0.5	1.9	2.2	2.4			
Meat, fish & seafood	-0.4	-1.6	-0.8	-0.8	-0.9			
Fruit & vegetables	0.8	-0.4	0.1	-0.1	-0.4			
Condiments, confectionery etc.	0.3	-1.3	-0.3	-0.5	-0.3			
Bakery products, flour & cereals	-2.0	-3.5	-3.2	-2.5	-2.9			
Non-alcoholic beverages	-2.8	-4.1	-3.5	-3.1	-3.4			
Dairy products	-2.3	-1.8	-2.7	-2.0	-2.8			
Other food	3.8	6.1	6.3	6.2	6.7			
Total food	0.5	-0.9	0.1	0.2	0.3			
Excluding meals out & fast foods	-0.2	-1.1	-0.7	-0.7	-0.8			
Total food expenditure								
Meals out & fast foods	2.5	1.7	2.8	3.6	3.9			
Meat, fish & seafood	0.1	0.5	0.0	0.5	0.6			
Fruit & vegetables	1.3	1.7	0.9	1.2	1.0			
Condiments, confectionery etc.	0.8	0.8	0.5	0.8	1.1			
Bakery products, flour & cereals	-1.5	-1.4	-2.4	-1.2	-1.5			
Non-alcoholic beverages	-2.3	-2.0	-2.7	-1.8	-2.0			
Dairy products	-1.8	0.3	-1.9	-0.7	-1.3			
Other food	4.3	8.4	7.1	7.6	8.2			
Total food	1.0	1.3	0.9	1.5	1.8			
Excluding meals out & fast foods	0.3	1.1	0.1	0.6	0.6			

Table D2 Food expenditure, by food type & net worth quintile, 2009-10 to 2015-16: growth rates

Note: Average annual growth rate between 2009-10 and 2015-16, based on values in 2015-16 prices. Food includes nonalcoholic beverages. Each quintile comprises 20% of households based on household net worth where, for example, quintile 1 is the lowest 20% of households.

Sources: ABS 2017a,b, 2011

By age category

Over the period 2009-10 to 2015-16, food expenditure per person increased, on average, in all age categories except the 25-34 years group (no change) and the 45-54 years group (-0.6 per cent a year). The revealed preference for spending more on meals out and fast foods, at least on average, was evident in all age categories (Table D3). In nearly all other cases, expenditure per person fell over the period (exceptions included, most notably, fruit and vegetables in the 15-24 years and 35-44 years groups, and other food).

Total food expenditure increased in all age categories where the population increased with particularly strong growth, on average, in the 65 years plus group (4.2 per cent a year) and the 55-64 years group (2.7 per cent a year); total food expenditure fell in the 15-24 years group (-2.7 per cent a year) and 35-44 years group (-0.1 per cent a year).

Variable	15-24	25-34	35-44	45-54	55-64	65 plus
	%	%	%	%	%	%
Population and income						
No. households	-2.1	0.4	-0.2	0.8	1.0	3.5
No. persons	-3.1	1.6	-0.3	0.9	2.4	4.0
After-tax income per person	0.9	-1.3	1.1	0.5	0.3	2.1
Household net worth per person	7.1	-0.1	0.0	-1.0	-0.5	2.2
Average food expenditure per person						
Meals out & fast foods	0.7	1.8	2.3	0.4	2.5	2.5
Meat, fish & seafood	-0.9	-2.7	-1.2	-0.8	-1.1	-0.4
Fruit & vegetables	1.1	-0.2	0.7	-1.1	-0.7	-0.2
Condiments, confectionery etc.	-1.5	-1.9	-0.7	-0.4	0.1	0.6
Bakery products, flour & cereals	-3.6	-3.5	-2.6	-2.9	-3.1	-3.1
Non-alcoholic beverages	-3.5	-4.4	-4.6	-4.0	-2.8	0.1
Dairy products	-0.7	-3.7	-2.3	-2.6	-2.1	-1.9
Other food	9.8	8.0	6.7	5.3	6.4	2.0
Total food	0.4	0.0	0.2	-0.6	0.3	0.2
Excluding meals out & fast foods	0.3	-1.2	-0.7	-1.0	-0.8	-0.6
Total food expenditure						
Meals out & fast foods	-2.4	3.5	2.0	1.3	5.0	6.6
Meat, fish & seafood	-4.0	-1.1	-1.5	0.1	1.3	3.6
Fruit & vegetables	-2.1	1.4	0.4	-0.2	1.6	3.8
Condiments, confectionery etc.	-4.6	-0.3	-1.0	0.5	2.5	4.6
Bakery products, flour & cereals	-6.6	-2.0	-2.9	-2.0	-0.7	0.8
Non-alcoholic beverages	-6.5	-2.9	-4.9	-3.2	-0.4	4.1
Dairy products	-3.8	-2.2	-2.6	-1.8	0.3	2.0
Other food	6.5	9.7	6.4	6.2	8.9	6.1
Total food	-2.7	1.6	-0.1	0.3	2.7	4.2
Excluding meals out & fast foods	-2.8	0.3	-1.0	-0.2	1.6	3.4

Table D3 Food expenditure, by food type & age category, 2009-10 to 2015-16: growth rates

Note: Average annual growth rate between 2009-10 and 2015-16, based on values in 2015-16 prices. Food includes non-alcoholic beverages.

Sources: ABS 2017a,b, 2011

Appendix E: Indicative price ratios across population sub-groups, 2015-16

Using data from chapter 3, it is possible to rank average food expenditure per person in 2015-16 in each population sub-group, including the average for all households in Australia (E_{Aus}).

The ranking across the five income quintiles (subscript Y, Table 7) is:

(1) $E_{Y2} < E_{Y1} < E_{Y3} < E_{Aus} < E_{Y4} < E_{Y5}$

The ranking across the five net worth quintiles (subscript NW, Table 8) is:

(2)
$$E_{NW1} < E_{NW2} < E_{NW3} < E_{Aus} < E_{NW4} < E_{NW5}$$

The ranking across the seven age categories (subscript in years, Table 9) is:

$$(3) \qquad E_{75+} < E_{35-44} < E_{25-34} < E_{15-24} < E_{Aus} < E_{45-54} < E_{65-74} < E_{55-64}$$

Each set of inequalities may be divided by the Australian average to derive a food expenditure ratio (see Figure 22, Table 18, Table 19 and Table 20). If the quantity of food purchased and consumed by individuals is the same, on average, across population sub-groups, the rankings for the food price ratio are consistent with the rankings for the food expenditure ratio (see Box 1 for further information). The benchmark food price is the Australian average food price, P_{Aus}, and the benchmark price ratio is equal to 1.

The ranking for the indicative food price ratio across the five income quintiles is:

(4)
$$P_{Y2}/P_{Aus} < P_{Y1}/P_{Aus} < P_{Y3}/P_{Aus} < 1 < P_{Y4}/P_{Aus} < P_{Y5}/P_{Aus}$$

The ranking for the indicative food price ratio across the five net worth quintiles is:

(5)
$$P_{NW1}/P_{Aus} < P_{NW2}/P_{Aus} < P_{NW3}/P_{Aus} < 1 < P_{NW4}/P_{Aus} < P_{NW5}/P_{Aus}$$

The ranking for the indicative food price ratio across the seven age categories is:

(6)
$$P_{75+}/P_{Aus} < P_{35-44}/P_{Aus} < P_{25-34}/P_{Aus} < P_{15-24}/P_{Aus} < 1 < P_{45-54}/P_{Aus} < P_{65-74}/P_{Aus} < P_{55-64}/P_{Aus}$$

Thus, for example, a population sub-group with a price ratio significantly below 1 may be interpreted as representing a market segment where the main economic opportunity for food producers is to supply food at least cost (that is, price is a key driver of food choices). Similarly, a population sub-group with a price ratio significantly above 1 may represent a market segment where there are additional economic opportunities for food producers as this group of people have demonstrated a willingness to spend more on food with reliable quality attributes (that is, food producers receive a return on investment in reliable food quality).

Appendix F: Illustrative framework: pathways to lower expected health risk

Chapter 6 briefly examined nutrition security issues noting there may be a useful role for government to provide consumers with more nuanced and accessible information about the health implications of food choices and lifestyle options. This appendix outlines a simple illustrative framework that provides an indicative rating of an individual's expected health risk according to a range of food consumption and lifestyle attributes (Table F1).

- **Nutrition gaps in diet**—refers to inadequate consumption of one or more core food group; qualitative categories include low, medium and high.
- % consumption of discretionary food in diet—qualitative categories include low, medium and high.
- Size category—categories include ideal size, overweight, obese and morbidly obese.
- **Exercise level**—qualitative categories include low, medium and high.

The quantity of food consumed by an individual, including both core and discretionary food types, is implicit in the table; for example, a high % consumption of discretionary food in the diet may be associated with adequate or inadequate consumption of core food groups.

	% consumption of discretionary food in diet								
Attribute/category	Low			Medium			High		
Exercise level	High	Medium	Low	High	Medium	Low	High	Medium	Low
Nutrition gaps, by size	e categor	y							
Ideal size									
Low	1	2	3	2	3	4	3	4	5
Moderate	2	3	4	3	4	5	4	5	6
High	3	4	5	4	5	6	5	6	7
Overweight									
Low	2	3	4	3	4	5	4	5	6
Moderate	3	4	5	4	5	6	5	6	7
High	4	5	6	5	6	7	6	7	8
Obese									
Low	3	4	5	4	5	6	5	6	7
Moderate	4	5	6	5	6	7	6	7	8
High	5	6	7	6	7	8	7	8	9
Morbidly obese									
Low	4	5	6	5	6	7	6	7	8
Moderate	5	6	7	6	7	8	7	8	9
High	6	7	8	7	8	9	8	9	10

Table F1 Illustrative expected health risk rating, by attribute

Note: Nutrition gaps refer to insufficient consumption of one or more core foods in diet. The baseline case is assumed to be a combination of low nutrition gaps, low % consumption of discretionary food, ideal size and high exercise level. The baseline case is assigned a value of one and, for simplicity, a value of one is added for each additional risk factor. Overall, a lower number is assumed to be associated with a lower expected health risk.
The baseline case is selected to represent a relatively low expected risk of adverse health outcomes (all else constant) is a combination of low nutrition gaps, low consumption of discretionary food, ideal size and high exercise level. All other combinations across the four attributes are ranked against the baseline case. The baseline case is assigned a value of one and, for simplicity, a value of one is added for each additional risk factor. A rating closer to one is likely to be associated with a lower expected health risk (all else constant).

Table F1 is a framework that some people may find useful to identify a pathway of incremental food consumption and lifestyle changes that reduce expected health risks over time (all else constant). This illustrative framework provides a ranking of marginal changes from a current position; there is no attempt to quantify expected health risks for any combination of categories (this may be referred to as a non-parametric approach).

In economic terms, a person may choose the least-cost pathway to a lower expected health risk over time because incremental or marginal changes are adopted that best suit the circumstances of the individual, and are more likely to be sustained. Table F1 may be used to identify high priority target areas for change. If nutrition gaps are high, an initial incremental change may be to select a food item from the core food group that is currently in shortfall; for example, a marginal change may be to consume a piece of fruit at the end of lunch each day. For some people who have drifted to a higher number over a period of time, the initial priority may be to make incremental changes to stabilise and avoid moving to a higher number (for example, an initial change may be to walk around the block at home or work at least once a day; follow-up incremental changes may involve extending the length and/or frequency of the walks).

If an incremental change is maintained over a few weeks and is found to be satisfactory, consider further options and choose a new incremental change (and so on). If an incremental change doesn't work (for example, it doesn't suit the person's lifestyle), drop that change and try something else; possibly revisit that particular experimental incremental change at some point in the future and reassess its long-term viability.

The key feature of the framework is flexibility in both the timing and nature of food consumption and lifestyle changes. A person may choose to pause or stop making further incremental changes at any time, or reconfigure food consumption and lifestyle choices through the lifecycle. The layout of the table is only illustrative of the type of information that an individual (or household) may find useful in finding a pathway of food consumption and lifestyle changes that, if adopted, reduce expected health risks over time (all else constant).

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