Significance of Employing a Multilateral Index Formula for Interstate Comparisons: A Case Study of the Australian Farm Sector

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Abstract. The paper demonstrates the drawbacks on using official data and binary indices when attempting an interstate comparison of output and productivity growth. The use of official data in one's national currency still requires a numerary currency due to price variations across states. Even with the use of index number formulas, some indices have shown to fail the transitivity property when more than 2 states are concerned. Hence the paper aims to demonstrate the significance of using a multilateral index formula like the Geary-Khamis (GK) method, EKS method and CCD method for derivation of appropriate currency converters or purchasing power parities (PPPs) to enable proper quantification of real output at the multilateral level. Subsequently, the paper demonstrates the variations in results between official aggregates and multilateral aggregates based on the GK method.

JEL Classification: C43, O47

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1. Introduction

The purpose of this paper is not to dwell into the theorems of index number formulas but to illustrate with real data the outcomes of using multilateral index formulas over bilateral index formulas when considering a study involving more than 2 states/regions. It is well-known that international comparative studies involving more than two countries require the use of multilateral index formula (Drechsler, 1973). However, this approach does not end there as it is also applicable at the regional, firm as well as plant level (Coelli, Rao and Battese, 2002). Studies which have focused on regions or states within a country include Knopke, Strappazzon and Mullen (1995), Islam (2000) and Knopke, O'Donnell and Shepherd (2000). These studies which focused mainly on broad acre level or specific regions like wheat-sheep zone or by type of crop use the Theil-Tornqvist method to derive productivity indices. There are also studies which simply use state aggregates to compare growth rates between states such as Harris and Harris (1992), Neri (1998), Martin, Lubulwa,

Chapman and Love (2001) and Nguyen, Smith and Meyer-Boehm (2003). While it may seem straight-forward to simply compare each state's gross state product as a form of output performance, there is still the need to remove the price differentials of products across states. Furthermore, any study which involves more than two regions/countries must satisfy the properties of 'transitivity' and 'base-invariance' which the Theil-Tornqvist does not.

While the basic issues regarding the conversion of value aggregates into a comparable form is recognised, the current study focuses on the index number problems arising in a multilateral context. Index number formulas like the Laspeyres, Paasche, Fisher and Theil-Tornqvist index are best suited for bilateral comparisons, but not at the multilateral level as they do not satisfy the transitivity property (Coelli, Rao and Battese, 2002). Transitivity is an important requirement that ensures internal consistency of comparisons between all pairs of countries in the context of a multilateral comparison (Kravis, Heston and Summers (1982) and Drechsler (1973)).

Often considered important in the context of multilateral comparisons, is the symmetric treatment of all the countries/regions, referred to as the 'base-invariance' property. This property guarantees that all regions/countries are treated equally in the comparisons exercise, regardless of the order in which the regions/countries enter into comparisons.

The purpose of the paper is two-fold; first, to illustrate the transitivity property using real data based on the following multilateral index formulas, the Elteto-Koves-Szulc (EKS), Caves, Christensen and Diewert (CCD) and Geary-Khamis methods and various bilateral index formulas. To do this, the study draws upon the data of the ABS 1996-97 Agriculture aggregates for six states; second, to demonstrate the variations in results between using official aggregates and GK aggregates.

The paper is organised as follows. Section 2 describes the methodology of the multilateral index formulas used in the study. Section 3 describes the data used and some of its limitations. Section 4 demonstrates the transitivity property in relation to the various price indices and discusses the findings. The paper concludes with some brief remarks.

2. Methodology

In order to obtain consistent multilateral comparisons between states, one has to generate transitive indices. The following index numbers satisfy the transitivity property. Elteto and Koves (1964) and Szulc (1964) formulated an index known as the EKS which is a matrix of comparisons between all pairs of countries/states using the Fisher index number formula and is expressed as

$$EKS_{xz} = \prod_{i=1}^{M} \left[F_{xy} * F_{yz} \right]^{1/M} \quad (1)$$

where EKS_{xz} is the index between countries/states x and z through a link country/state y for i=1, 2, M and Fxz represent the Fisher index for any pair of states x and z. The choice of the Fisher index is mainly because of the ideal properties of the Fisher index as demonstrated by Diewert (1992).

Caves, Christensen and Diewert (1982) formulated a multilateral index formula using a generalised Theil-Tornqvist index (TT) usually referred to as the CCD index. The CCD index is derived from the work of Elteto and Koves (1964) and Szulc (1964) and is expressed as

$$CCD_{xz} = \prod_{i=1}^{M} \left[TT_{xy} * TT_{yz} \right]^{1/M} \quad (2)$$

where CCD_{xz} is the index between countries/states x and z through a link country/state y for i=1, 2, M. Both the EKS and CCD index are transitive in nature.

Another multilateral index formula used in the study is the Geary-Khamis (GK) method, developed by Geary (1958) and Khamis (1972) [1]. This method is also widely used in international comparisons (see Kravis, Heston and Summers, 1978 and 1982; OECD, 1990).

Geary (1958) provided the framework underlying this method based on the idea of the purchasing power parity (PPP) of a currency. This framework was further refined by Khamis (1972) who described the mathematical and statistical properties of the GK method.

The GK method derives PPPs for different currency units (PPP for the currency of country *j*), and average international prices for each of the commodities included (P_i for commodity i). While the current study is an interstate comparison rather than an international comparison, the application is still feasible as different

[1] See Rao (1993) or Rao, Maddison and Lee (in Maddison. Rao and Shepherd (eds), 2002) for a detailed description of the computational procedures and properties of the Geary-Khamis method.

states have different producer price levels for all commodities which indicate that one Australian dollar will still have a different purchasing power between states. The GK method is appealing as it produces PPPs for converting principal aggregates, as well as interstate average prices for each commodity which allows for more disaggregated level of comparison. The PPPs and interstate average prices P_i are expressed as functions of the observed price and quantity data from different states using the following interdependent system of equations. For the currency of state j, the PPP is defined as:

$$PPP_j = \frac{\sum_{i=1}^{N} p_{ij} q_{ij}}{\sum_{i=1}^{N} P_i q_{ij}} \tag{3}$$

where: p_{ij} and q_{ij} are, respectively, the price and quantity of i-the product for state j.

Equation (3) shows the number of currency units of state j that are equivalent in purchasing power to one unit of the numerary currency unit in which the interstate average prices are specified. The interstate prices (P_i) are each expressed as:

$$P_i = \frac{\sum_{j=1}^{M} \left(p_{ij} q_{ij} \Big/ PPP_j \right)}{\sum_{s=1}^{M} q_{ij}} \tag{4}$$

Geary-Khamis equations (3) and (4) are an independent system of equations which are solved by using observed price and quantity data on N commodities from M states to determine (i) M purchasing power parities: PPP_1, PPP_2, ..., PPP_M; and (ii) N commodity interstate average prices: P_1, P_2, ..., P_N.

Khamis (1972) proved that if one of the PPPs is set to unity, then the rest of the unknown parities and interstate prices can be solved uniquely. This offers a choice as to which state's currency is set to unity. In the current study, New South Wales (NSW) is used as the reference state for which the PPP is set to unity (ie. equalling 1). Solving equations (3) and (4) will lead to numerical values of PPPs and P_is respectively. The interstate prices are average prices for all commodities across all states involved in the multilateral comparisons. For purposes of comparing value

aggregates across states, the Geary-Khamis method offers the flexibility of using PPPs directly for conversion of aggregates or using interstate prices to revalue the quantities.

3. Sources and Data Limitations

The data source for the benchmark year 1996-97 drawn from the Australian Bureau of Statistics, Agriculture, Cat No. 7113.0 provided detailed information for quantity produced and value output. Of the 77 commodities, a sample of 65 commodities was used in deriving the PPPs. These are provided in Appendix 1. Essentially, derivation of price index requires price and quantity data. Value output and production levels drawn from ABS, Agriculture 1996-97, Cat. No. 7113.0 were used to derive average unit prices for each commodity implicitly. Unfortunately, not all commodities were included due to the following reasons.

The first problem in the data was that of "holes". These "holes" are simply data which was either not collected or not published, or that the state produces an insignificant amount or simply does not produce that commodity. As such, the current study focuses on six states, namely New South Wales (NSW), Victoria (Vic), Queensland (Qld), South Australia (SA), Western Australia (WA) and Tasmania (Tas). Northern territory was not included due to the above-mentioned data problems while the Australian Capital Territory aggregates were incorporated in NSW. Another data problem was that some commodities had production estimates but had no gross value[2]. This implied that the derivation of the PPPs and interstate average prices for the benchmark year 1996-97 is based on a selected number of commodities which is less than the total number of agricultural products produced.

While the sample of commodities may not account for all agricultural products, based on the data used for 1996-97, the gross value for each state at each state's price shows that the proportion of data used is above 70% which is an ideal coverage in deriving reliable PPPs. The ratios of the sample gross value to total gross value for each state are as follows: NSW (73%), Vic (86%), Qld (83%), SA (87%), WA (83%), Tas (72%).

[2] For example, commodities such as beetroot and peas (see ABS, Agriculture 1996-97, cat. No. 7113.0, p. 60 and 62).

4. Empirical Results

4.1 Outcome of using binary indices in multilateral study

In this section we consider the outcome of deriving price index numbers when more than 2 states are involved. In a study which takes into account more that 2 states, we are typically interested in all pairs of comparisons, ie. across all pairs of states. For a pair of states (x,z) an index, I_{xz} can be derived. Using the Laspeyres, Paasche, Fisher and Theil-Tornqvist price index formulae, and considering all pairs of states, (x,z) with x,z = 1,2,….,M we derive a matrix of index numbers comparisons between all pairs of states (see Coelli, Rao and Batteses (2002) for details on these price indices).

$$\begin{bmatrix} I_{11} & I_{12} & K & I_{1M} \\ I_{21} & I_{22} & K & I_{2M} \\ M & & & \\ I_{M1} & I_{M2} & K & I_{MM} \end{bmatrix}$$

This matrix represents all multilateral comparisons involving M states and ideally all comparisons should be internally consistent, ie. satisfy the transitivity property. To illustrate the transitivity property, assuming I_{xz} to be an index number formula, where X and Z are two countries/states, transitivity requires that for all triplets (sets of three countries/state - X, Y and Z):

$$I_{xz} = I_{xy} \times I_{yz}$$

In this equation, $I_{xy} \times I_{yz}$ is an indirect comparison between countries/states X and Z through a third or link country/state Y, whereas I_{xz} is a direct comparison. Therefore, transitivity requires that the direct and indirect comparisons provide the same index.

Using the price and quantity of the 65 commodities for the 6 states (see Section 4 for details on data source and limitations), we derive the Laspeyres, Paasche, Theil-Tornqvist and Fisher index numbers for all pairs of states as shown in Tables 1, 2, 3 and 4.

[INSERT Tables 1, 2, 3, 4]

Using the above tables, we can prove that all four indices fail the transitivity property.

From the Laspeyres Price index, a direct comparison between NSW and Qld is 0.944

(Qld being the base state). For an indirect comparison between NSW and Qld through Vic, this would be given by

$$I_{NSW,Vic} * I_{Vic,Qld} = 1.221 * 0.580 = 0.708 \neq 0.944$$

which does not satisfying the transitivity property. If we were to use SA as the intermediate state, then this would be given as

$$I_{NSW,SA} * I_{SA,Qld} = 1.070 * 0.625 = 0.668 \neq 0.944$$

Using the Theil-Tornqvist index with Vic as the intermediate state between NSW and Qld,

$$I_{NSW,Vic} * I_{Vic,Qld} = 1.146 * 0.793 = 0.909 \neq 0.944$$

Using the Fisher index with Vic as the intermediate state between NSW and Qld,

$$I_{NSW,Vic} * I_{Vic,Qld} = 1.154 * 0.645 = 0.744 \neq 0.962$$

The same result happens where the property of transitivity fails. What this implies is that the use of any binary index formula in determining output and productivity levels across states is biased as there is no internal consistency.

4.2 Outcome of using Multilateral index formulas

The EKS price indices and the CCD price indices are shown in Tables 5 and 6 and satisfy the transitivity property which can be proven as follows.

A direct comparison between NSW and Qld is 0.861 (Qld being the base state). For an indirect comparison between NSW and Qld through Vic, this would be given by

$$I_{NSW,Vic} * I_{Vic,Qld} = 1.239 * 0.695 = 0.861 = I_{NSW,Qld}$$

[INSERT Table 5]

As a result of satisfying the transitivity property, this method is widely used by international organisations such as EUROSTAT and OECD

[INSERT Table 6]

Table 6 price indices based on the CCD approach satisfies the transitivity property as follows. A direct comparison between NSW and Qld is 0.939 (Qld being the base state). For an indirect comparison between NSW and Qld through Vic, this would be given by

$$I_{NSW,Vic} * I_{Vic,Qld} = 1.159 * 0.810 = 0.939 = I_{NSW,Qld}$$

What this tells us is that regardless on whether a direct or indirect comparison is attempted, one should obtain the same results, this ensuring that internal consistency is achieved.

[INSERT Table 7]

The GK price indices also satisfies the transitivity property whereby

$$I_{NSW,Vic} * I_{Vic,Qld} = 1.034 * 1.500 = 1.550 = I_{NSW,Qld}$$

4.3 Gross Farm Product based on GK PPPs and 1996-97 constant prices

In this section, a brief comparison of output based on two sets of prices is compared (constant price viz-a-viz GK PPPs). GK Purchasing Power Parities for the benchmark year 1996-97 are derived first before applying them to each state's gross farm product to arrive at the gross farm product at GK PPPs for all other years. Both results are presented in Tables 8 and 9.

[INSERT Tables 8 and 9]

From Table 8 with New South Wales indexed at 100, Victoria's farm output for the year 1996-97 was 89 while Queensland was 63. Converted using GK PPPs shown in Table 9 with NSW equalling 100, Victoria's output was 106 while Queensland was 59. Such discrepancy in results is clear indication that in any type of cross-sectional comparison, appropriate converters must be employed. Furthermore, one cannot rely on official aggregates as they do not take into account price variation across states.

5. Conclusion

The main focus of the paper was to demonstrate the significance of a multilateral index formula over the bilateral index formulas by means of testing the transitivity property. For the benchmark year 1996-97, when price differentials were not taken into consideration, the results showed that NSW had the greatest output based on Australian Bureau of Statistics data. However, when the GK PPPs were used, results showed that Victoria's output was above that of NSW level. Over the period 1991 to 1999, Victoria's output was the highest amongst all other states and higher than the official figures which demonstrate that using interstate official aggregates can still cause biasness in output and productivity growth.

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Table 1

Laspeyres Price Indices

	Base State					
	NSW	**Vic**	**Qld**	**SA**	**WA**	**Tas**
NSW	1.000	1.221	0.944	1.070	1.020	1.278
Vic	0.916	1.000	0.580	0.949	0.928	1.118
Qld	1.020	1.396	1.000	1.319	0.913	1.402
SA	0.889	1.173	0.625	1.000	0.952	1.298
WA	1.063	1.392	1.031	1.134	1.000	1.448
Tas	0.736	0.996	0.454	0.976	0.765	1.000

Table 2

Paasche Price Indices

	Base State					
	NSW	**Vic**	**Qld**	**SA**	**WA**	**Tas**
NSW	1.000	1.092	0.981	1.125	0.941	1.358
Vic	0.819	1.000	0.717	0.853	0.719	1.004
Qld	1.059	1.724	1.000	1.601	0.970	2.201
SA	0.934	1.053	0.758	1.000	0.881	1.025
WA	0.980	1.077	1.095	1.051	1.000	1.306
Tas	0.783	0.894	0.713	0.770	0.691	1.000

Table 3

Theil-Tornqvist Price Indices

	Base State					
	NSW	**Vic**	**Qld**	**SA**	**WA**	**Tas**
NSW	1.000	1.146	0.944	1.053	0.969	1.163
Vic	0.873	1.000	0.793	0.905	0.826	1.024
Qld	1.059	1.260	1.000	1.131	0.988	1.254
SA	0.950	1.105	0.884	1.000	0.922	1.105
WA	1.032	1.211	1.012	1.085	1.000	1.255
Tas	0.860	0.976	0.797	0.905	0.797	1.000

Table 4

Fisher Price Indices

	Base State					
	NSW	**Vic**	**Qld**	**SA**	**WA**	**Tas**
NSW	1.000	1.154	0.962	1.097	0.979	1.317
Vic	0.866	1.000	0.645	0.900	0.817	1.059
Qld	1.039	1.551	1.000	1.453	0.941	1.756
SA	0.911	1.112	0.688	1.000	0.916	1.153
WA	1.021	1.225	1.062	1.092	1.000	1.375
Tas	0.759	0.944	0.569	0.867	0.727	1.000

Source: ABS, Agriculture 1996-97 Cat. No. 7113.0

Table 5
EKS (Fisher) Price Indices

	Base State					
	NSW	**Vic**	**Qld**	**SA**	**WA**	**Tas**
NSW	1.000	1.239	0.861	1.135	0.961	1.352
Vic	0.807	1.000	0.695	0.916	0.776	1.091
Qld	1.162	1.440	1.000	1.319	1.117	1.571
SA	0.881	1.092	0.758	1.000	0.847	1.192
WA	1.040	1.289	0.895	1.181	1.000	1.407
Tas	0.740	0.916	0.636	0.839	0.711	1.000

Source: ABS, Agriculture 1996-97 Cat. No. 7113.0

Table 6
EKS (TT) Price Indices (CCD)

	Base State					
	NSW	**Vic**	**Qld**	**SA**	**WA**	**Tas**
NSW	1.000	1.159	0.939	1.052	0.952	1.177
Vic	0.863	1.000	0.810	0.908	0.822	1.016
Qld	1.065	1.234	1.000	1.121	1.014	1.254
SA	0.950	1.101	0.892	1.000	0.905	1.119
WA	1.050	1.217	0.986	1.105	1.000	1.236
Tas	0.850	0.984	0.798	0.894	0.809	1.000

Source: ABS, Agriculture 1996-97 Cat. No. 7113.0

Table 7
Geary-Khamis (GK) Price Indices

	Base State					
	NSW	**Vic**	**Qld**	**SA**	**WA**	**Tas**
NSW	1.000	1.034	1.550	2.344	1.752	9.868
Vic	0.968	1.000	1.500	2.268	1.131	4.210
Qld	0.645	0.667	1.000	1.512	1.131	6.367
SA	0.427	0.441	0.661	1.000	0.748	4.210
WA	0.571	0.590	0.884	1.338	1.000	5.631
Tas	0.101	0.105	0.157	0.238	0.178	1.000

Source: ABS, Agriculture 1996-97 Cat. No. 7113.0

Appendix 1
Agricultural Commodity Production in 1996/97 (MT[a])

	NSW	Vic	Qld	SA	WA	Tas
CROPS AND PASTURES						
Cereals for grain						
Barley	1,483,000	1,189,000	429,000	1,923,000	1,635,000	35,000
Grain sorghum	417,000	3,000	1,003,000	0	2,000	0
Maize	256,000	7,000	130,000	0	5,000	0
Oats	607,000	304,000	26,000	156,000	546,000	14,000
Rice	1,248,000	6,000	0	0	0	0
Triticale	317,000	167,000	6,000	141,000	35,000	7,000
Wheat	8,363,000	2,262,000	1,980,000	2,795,000	7,516,000	8,000
Legumes						
Lupins for grain	96,000	52,000	0	102,000	1,272,000	0
Field peas for grain	18,000	213,000	0	195,000	26,000	1,000
Crops cut for Hay						
Cereals for hay	229,000	189,000	52,000	330,000	413,000	6,000
Non cereals for hay	15,000	26,000	21,000	23,000	19,000	4,000
Oilseeds						
Canola	331,000	132,000	0	53,000	108,000	0
Other crops						
Sugar cane for crushing	2,231,000	0	36,232,000	0	170,000	0
Peanuts (in shell)	1,000	0	46,000	0	0	0
Tobacco	0	4,000	5,000	0	0	0
Pastures and grasses cut for Hay						
Lucerne	412,000	187,000	179,000	84,000	21,000	12,000
Other	355,000	1,255,000	66,000	249,000	325,000	204,000
HORTICULTURE						
Citrus						
Oranges	231,543	88,963	16,126	180,683	5,308	0
Lemons and Limes	5,679	5,371	6,428	13,706	794	0
Mandarins	5,566	5,319	44,566	16,004	1,472	0
Pome						
Apples	83,231	118,968	28,045	28,865	38,218	55,649
Pears (excl. Nashi)	3,195	146,060	1,496	6,136	9,932	742
Stone						
Apricots	926	8,936	277	15,235	341	205
Cherries	3,439	2,008	2	948	101	185
Nectarines	8,030	7,033	2,556	1,362	2,859	41
Peaches	15,411	43,487	3,297	7,694	2,191	17
Plums and prunes	10,409	4,618	1,972	4,271	3,912	6

Appendix 1 - continued
Agricultural Commodity Production in 1996/97 (MT[a])

	NSW	Vic	Qld	SA	WA	Tas
Other orchard nei.						
Avocados	4,199	1,793	11,744	901	1,445	0
Mangoes	273	0	28,366	0	1,095	0
Nuts						
Almonds	144	3,731	1	2,014	3	0
Macadamia	9,675	0	6,374	0	3	0
Kiwifruit	418	2,255	255	0	453	0
Raspberries	31	208	10	5	2	105
Strawberries	210	3,376	3,755	1,322	2,444	129
Tropical						
Bananas	38,914	0	143,748	0	13,360	0
Papaw	124	0	5,793	0	174	0
Grapes	209,901	329,687	4,530	374,589	21,796	1,497
VEGETABLES						
Asparagus	2,534	4,252	821	123	111	13
Beans, French and runner	2,197	2,038	18,391	128	690	14,154
Broccoli	3,407	19,198	9,116	1,828	2,649	4,253
Cabbages and brussels sprouts	11,124	25,375	13,920	7,131	5,075	3,376
Capsicum, chillies and peppers	559	3,353	24,403	1,542	2,226	8
Carrots	13,765	99,274	28,522	40,307	52,992	22,546
Cauliflowers	11,691	17,409	10,518	3,709	16,213	4,851
Celery	195	22,403	11,717	4,247	5,922	389
Cucumbers	5,264	795	6,778	1,153	1,726	157
Lettuces	12,967	36,557	42,251	6,085	10,197	2,457
Marrows, squashes and zucchinis	1,859	1,035	8,942	163	750	669
Melons						
Water	6,058	1,155	55,262	463	22,950	0
Rock and cantaloupe	11,094	7,856	36,890	3,703	10,454	0
Mushrooms	12,260	14,237	4,165	2,653	1,315	856
Onions, white and brown	13,816	15,615	21,789	65,274	20,321	59,677
Potatoes	136,173	315,727	115,435	285,344	116,004	317,448
Pumpkins	19,731	4,595	38,688	6,895	14,513	1,885
Sweet corn	34,273	7,366	14,822	1,294	1,668	5,352
Tomatoes	102,795	167,563	109,911	3,069	9,038	682
LIVESTOCK SLAUGHTERINGS AND LIVESTOCK PRODUCTS						
Livestock products						
Cattle and calves (no.)	2,297,000	2,373,000	2,639,000	385,000	413,000	248,000
Sheep and lambs (no.)	8,862,000	8,786,000	1,762,000	4,066,000	4,716,000	748,000
Pigs (no.)	1,338,000	1,197,000	1,002,000	427,000	550,000	75,000
Poultry (no.)	133,364,000	86,733,000	61,089,000	28,008,000	36,360,000	0
Wool	195,481	175,209	45,850	89,579	160,022	18,876
Whole milk (L)	1,192,000,000	5,622,000,000	797,000,000	535,000,000	349,000,000	529,000,000
Eggs (doz)	74,870,000	44,670,000	22,225,000	10,706,000	15,684,000	4,001,000
Beekeeping						
Honey produced	12,620	4,403	4,190	3,036	1,729	1,012
Beeswax produced	234	76	68	58	40	14

Source: ABS, Agrculture 1996-97, Cat No. 7113.0.
(a) units are in MT unless otherwise specified.
"0" indicates either data was not collected or not published.

Appendix 1 - continued
Value Output ($mill), 1996/97

	NSW	Vic	Qld	SA	WA	Tas
CROPS AND PASTURES						
Cereals for grain						
Barley	332.6	242.0	66.7	358.6	299.6	6.6
Grain sorghum	77.2	0.6	179.0	0.0	0.3	0.0
Maize	51.1	1.8	25.4	0.0	1.3	0.0
Oats	87.3	42.7	4.6	19.2	70.7	2.2
Rice	307.6	2.7	0.0	0.0	0.0	0.0
Triticale	49.2	29.1	1.0	20.8	5.1	1.3
Wheat	1,746.8	484.9	421.6	602.1	1,621.1	1.4
Legumes						
Lupins for grain	21.1	12.2	0.0	23.0	193.0	0.0
Field peas for grain	4.4	52.7	0.0	47.7	6.0	0.1
Crops cut for Hay						
Cereals for hay	24.9	22.4	6.2	39.0	48.9	0.9
Non cereals for hay	2.2	3.8	2.3	1.7	2.2	0.2
Oilseeds						
Canola	126.5	48.1	0.0	21.4	42.6	0.0
Other crops						
Sugar cane for crushing	71.6	0.0	1,112.0	0.0	2.9	0.0
Peanuts (in shell)	0.8	0.0	34.1	0.0	0.0	0.0
Tobacco	0.0	24.8	28.8	0.0	0.0	0.0
Pastures and grasses cut for Hay						
Lucerne	47.0	27.7	21.7	12.3	4.3	3.0
Other	30.4	154.7	10.1	43.7	30.5	26.3
HORTICULTURE						
Citrus						
Oranges	116.2	48.3	11.0	86.1	2.2	0.0
Lemons and Limes	9.9	3.1	7.3	10.2	0.5	0.0
Mandarins	7.1	7.0	56.7	13.9	2.1	0.0
Pome						
Apples	98.0	124.4	26.8	48.7	41.3	54.2
Pears (excl. Nashi)	1.8	87.1	1.0	7.4	8.1	0.6
Stone						
Apricots	2.5	6.5	0.5	32.1	0.5	0.4
Cherries	13.8	8.3	0.0	8.4	1.1	2.2
Nectarines	14.0	12.3	4.8	3.6	6.4	0.1
Peaches	15.6	27.4	5.2	8.2	3.7	0.0
Plums and prunes	16.8	5.0	3.1	6.6	7.0	0.0

Appendix 1 - continued
Value Output ($mill), 1996/97

	NSW	Vic	Qld	SA	WA	Tas
Other orchard nei.						
Avocados	7.7	3.3	24.7	2.4	3.9	0.0
Mangoes	0.7	0.0	54.9	0.0	4.8	0.0
Nuts						
Almonds	0.8	24.9	0.0	13.4	0.0	0.0
Macadamia	36.8	0.0	18.0	0.0	0.0	0.0
Kiwifruit	0.8	3.6	0.4	0.0	1.2	0.0
Raspberries	0.3	2.0	0.3	0.0	0.0	0.7
Strawberries	0.9	13.3	22.0	8.3	10.8	0.6
Tropical						
Bananas	53.0	0.0	140.6	0.0	18.9	0.0
Papaw	0.1	0.0	5.7	0.0	0.4	0.0
Grapes	156.8	214.7	14.4	298.3	29.2	3.0
VEGETABLES						
Asparagus	12.5	18.3	4.9	0.8	0.7	0.1
Beans, French and runner	1.9	4.4	27.8	0.3	1.6	5.5
Broccoli	6.0	28.0	15.1	2.9	3.5	5.2
Cabbages and brussels sprouts	4.6	11.5	10.5	7.6	5.1	2.4
Capsicum, chillies and peppers	0.5	3.4	28.6	4.5	3.3	0.0
Carrots	5.6	61.2	14.5	20.4	32.1	8.3
Cauliflowers	6.0	11.5	4.8	3.1	19.9	2.7
Celery	0.1	16.5	6.2	3.1	4.7	0.4
Cucumbers	3.4	1.1	7.2	1.6	2.7	0.4
Lettuces	10.9	20.7	29.5	4.6	7.4	2.5
Marrows, squashes and zucchinis	2.4	2.4	10.7	0.4	1.9	2.4
Melons						
Watermelon	1.9	0.7	18.0	0.1	8.8	0.0
Rock and cantaloupe	6.4	6.8	25.4	3.2	13.5	0.0
Mushrooms	39.0	59.7	15.0	11.5	5.7	0.1
Onions, white and brown	5.8	5.8	12.8	41.8	8.9	16.3
Potatoes	49.4	123.5	52.3	100.6	38.0	84.8
Pumpkins	9.7	1.1	15.6	3.8	6.5	0.5
Sweet corn	8.5	7.2	6.7	1.2	1.9	0.9
Tomatoes	16.9	36.6	111.9	4.8	5.8	1.0
LIVESTOCK AND LIVESTOCK PRODUCTS						
Livestock products						
Cattle and calves	772.6	662.5	1,232.9	137.6	282.1	75.1
Sheep and lambs	247.5	347.3	53.2	134.5	237.1	18.9
Pigs	214.3	168.6	160.3	54.4	73.5	np
Poultry	467.5	240.7	166.5	89.2	89.4	np
Wool	989.4	512.9	180.8	280.2	574.6	82.1
Whole milk	494.0	1,536.9	329.5	172.7	142.6	132.6
Eggs	123.1	57.8	36.7	14.4	29.3	9.0
Beekeeping						
Honey produced	21.5	7.5	7.0	5.2	2.6	2.0
Beeswax produced	1.3	0.4	0.4	0.3	0.2	0.1

Source: ABS, Agrculture 1996-97, Cat No. 7113.0.

Note: Beetroot and Parsnips not included as value output figures were not available.

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ISSN 1324-5910

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