

**Wish you were here? The economic impact of the tourism shutdown from Australia's 2019-20
'Black summer' mega-fires**

SUPPLEMENTARY INFORMATION

Vivienne Reiner¹, Navoda Liyana Pathirana^{1,2}, Ya-Yen Sun³, Manfred Lenzen¹, Arunima Malik^{1,4}

1. ISA, School of Physics A28, The University of Sydney, Sydney, New South Wales, 2006, Australia
2. Charles Perkins Centre, The University of Sydney, Sydney, New South Wales, 2006, Australia
3. Business School, The University of Queensland, Brisbane, Queensland, 4072, Australia
4. Sydney Business School, The University of Sydney, Sydney, New South Wales, 2006, Australia

Correspondence to: vivienne.reiner@sydney.edu.au

Table of contents

SI 1: Sector classification used in this study	3
SI 1.1 39 sectors distinguished in this study.....	3
SI 1.2 Correspondence between the 39 sectors and 10 broad sector groupings distinguished in this study.....	4
SI 2: Estimation of the gamma matrix of the tourism hit from the 2019-20 bushfires	7
SI 2.1: Total output	7
SI 2.2: Direct losses (\$ mil)	8
SI 2.3: Direct losses event matrix	9
SI 2.4: Capital damages event matrix	10
SI 2.5: Summary of Impact information.....	11
SI 2.6: Summary of infrastructure damage	11
SI 2.7: Calculations for the event matrix.....	13
SI 3: Testing the model	15
SI 4: National and regional losses	16
SI 4.1 National losses for consumption, income and employment across the 39 study sectors.....	16
SI 4.2: Regional consumption losses across the 39 study sectors	17
SI 4.3: Regional production layer decomposition for income and employment in broad sector groupings.....	20
SI 5: Underlying data for figures	22
SI 6: References	30

SI 1: Sector classification used in this study

SI 1.1 39 sectors distinguished in this study

1. Grapes
2. Apples, pears and stone fruit
3. Livestock
4. Other agriculture
5. Forestry
6. Fishing and seafood
7. Coal, oil and gas
8. Non-ferrous metal ores
9. Other mining
10. Wines
11. Other food manufacturing
12. Textiles, clothing and footwear
13. Wood and paper manufacturing
14. Automotive petrol
15. Chemicals, petroleum and coal products nec
16. Non-metallic mineral products
17. Metals, metal products
18. Machinery appliances and equipment
19. Miscellaneous manufacturing
20. Electricity supply, gas and water
21. Residential building construction
22. Other construction
23. Rail transport
24. Taxi transport
25. Other road transport
26. Air, water and other transport
27. Transport equipment rental
28. Travel agency and information centre services
29. Accommodation
30. Cafes, restaurants and take-away foods
31. Wholesale and retail trade
32. Ownership of dwellings
33. Cultural and recreational services;
34. Communication services
35. Finance, property and other business services
36. Government administration and defence
37. Education and training
38. Health and community services
39. Personal and other services

SI 1.2 Correspondence between the 39 sectors and 10 broad sector groupings
distinguished in this study

No	Sector name	Primary production	Mining	Manufacturing	Transport	Hospitality	Trade	Cultural, recreational	Travel agency	Education	Other services
1	Grapes - wine	1									
2	Apples, pears & stone fruit	1									
3	Livestock	1									
4	Other agriculture	1									
5	Forestry	1									
6	Fishing and seafood	1									
7	Coal, oil and gas		1								
8	Non-ferrous metal ores		1								
9	Other mining		1								
10	Wines			1							
11	Other food manufacturing			1							
12	Textiles, clothing and footwear			1							
13	Wood and paper manufacturing			1							
14	Automotive petrol			1							
15	Chemicals, petroleum and coal products nec			1							

16	Non-metallic mineral products			1							
17	Metals, metal products			1							
18	Machinery appliances and equipment			1							
19	Miscellaneous manufacturing			1							
20	Electricity supply, gas and water										1
21	Residential building construction										1
22	Other construction										1
23	Rail transport				1						
24	Taxi transport				1						
25	Other road transport				1						
26	Air, water and other transport				1						
27	Transport equipment rental				1						
28	Travel agency and information centre services								1		
29	Accommodation					1					
30	Cafes, restaurants and					1					

	take-away foods										
31	Wholesale and retail trade						1				
32	Ownership of dwellings										1
33	Cultural and recreational services							1			
34	Communication services										1
35	Finance, property and other business services										1
36	Government administration and defence										1
37	Education and training									1	
38	Health and community services										1
39	Personal and other services										1

SI 2: Estimation of the gamma matrix for the tourism impact from the 2019-20 bushfires

Table SI 2.1 Total output (x) (AU million dollars) by region and sector used for the estimation of the gamma matrix (γ).

	NSW	VIC	QLD	SA	WA	TAS	ACT	NT
1 Grapes - wine	209.93	471.78	40.23	531.92	139.97	46.113	5.2153	3.483
2 Apples, pears & stone fruit	342.41	648.29	236.47	217.87	172.89	245.2	2.6976	210.77
3 Livestock	10577	9131.8	6512.5	2975.3	3364.9	1675.8	53.02	446.53
4 Other agriculture	13144	9022.6	13275	5853.5	7019.6	851.46	77.444	320.14
5 Forestry	1285.4	877.31	739.03	422.94	544.2	802.22	85.623	58.623
6 Fishing and seafood	950.53	518.88	892.01	703.16	827.98	1184.5	17.927	207.96
7 Coal, oil and gas	37895	6458	51707	3756.3	47580	472.37	179.57	1760.7
8 Non-ferrous metal ores	6090.7	2954.6	11578	3109.1	21692	994.16	34.816	2489.1
9 Other mining	8988.3	5667.7	16017	3518.4	68093	1222	166.15	2361.1
10 Wines	1407.5	1472.8	478.25	915.84	648.01	144.47	75.08	46.047
11 Other food manufacturing	27570	27454	20072	6386.6	7364.3	2590.4	343.65	329.32
12 Textiles, clothing and footwear	2026.5	2107.1	916.74	367.16	688.26	113.89	40.962	55.282
13 Wood and paper manufacturing	7987.6	7747	4187.9	1915.5	2023.7	711.27	165.44	83.08
14 Automotive petrol	2874.1	2368.3	1897	174.19	763	62.077	37.772	51.616
15 Chemicals, petroleum and coal products neo	18933	18154	10223	3092	7339.3	857.55	201.89	255.4
16 Non-metallic mineral products	6313	4986.1	4084.7	1370.3	2465.7	424.26	153.17	300.63
17 Metals, metal products	27432	21407	19544	5301.2	18010	1718.3	342.88	1322.5
18 Machinery appliances and equipment	18293	20087	10101	5128.9	6544.2	707.41	206.69	341.02
19 Miscellaneous manufacturing	5444.1	5014.2	2398.6	863.26	1614.4	197.52	295.52	112.71
20 Electricity supply, gas and water	36650	30498	25330	9196.8	12500	2519.5	1054.5	906.67
21 Residential building construction	34182	28798	15459	5381.7	8174	1480	1193.5	795.88
22 Other construction	1.18E+05	1.02E+05	75288	20931	47653	5728.9	4800	3284.4
23 Rail transport	8957	2972.7	6398.7	637.11	1380.2	154.83	71.254	161.33
24 Taxi transport	851.68	751.37	601.36	217.9	400.64	86.399	65.335	53.659
25 Other road transport	18920	16637	13104	4249.4	7785	1184.3	509.51	531.51
26 Air, water and other transport	36827	27907	20658	5090.8	11104	1526.1	1074.4	1097.9
27 Transport equipment rental	738.15	321.76	467.97	168.75	237.68	172.46	50.142	61.503
28 Travel agency and information centre services	4473.2	2424.7	2662.5	665.89	1457	209.77	127.24	424.68
29 Accommodation	5795.4	3314.8	4452.2	904.45	2535.5	419.53	173.72	423.47
30 Cafes, restaurants and take-away foods	22705	17531	13625	4795.3	7063.1	1322.1	1151.7	677.39
31 Wholesale and retail trade	1.00E+05	80959	55848	19230	29256	5284	3413.4	2407.8
32 Ownership of dwellings	77444	39532	39586	14791	24561	4532.3	5881.6	3518.9
33 Cultural and recreational services;	18916	12585	9262.4	2348.1	3499.9	859.67	1078.8	731.8
34 Communication services	44921	30146	13247	5345.2	6523.7	1896.9	2348.1	530.97
35 Finance, property and other business services	2.81E+05	1.98E+05	1.20E+05	36972	70587	8586.3	13143	4302.7
36 Government administration and defence	54803	36528	29020	10269	14360	3070.8	14791	3850.4
37 Education and training	44032	35905	23724	8248.4	14029	2360.7	2663.3	1456.7
38 Health and community services	65596	52697	36522	13575	18036	4320.5	3634	2008.3
39 Personal and other services	10019	7897.9	6813.1	2195.6	3855.5	640.59	814.73	508.57

Table SI 2.2 Direct losses (AU million dollars) of tourism from the 2019-20 bushfires by region and sector. To convert these sector/regional losses into a direct-losses event matrix (γ), the regional financial losses are divided by the pre-catastrophe total output for those sectors (SI 2.1).

	NSW	VIC	QLD	SA	WA	TAS	ACT	NT	Total
1 Grapes - wine	0	0	0	0	0	0	0	0	0
2 Apples, pears & stone fruit	0	0	0	0	0	0	0	0	0
3 Livestock	0	0	0	0	0	0	0	0	0
4 Other agriculture	0	0	0	0	0	0	0	0	0
5 Forestry	0	0	0	0	0	0	0	0	0
6 Fishing and seafood	0	0	0	0	0	0	0	0	0
7 Coal, oil and gas	0	0	0	0	0	0	0	0	0
8 Non-ferrous metal ores	0	0	0	0	0	0	0	0	0
9 Other mining	0	0	0	0	0	0	0	0	0
10 Wines	0	0	0	0	0	0	0	0	0
11 Other food manufacturing	0	0	0	0	0	0	0	0	0
12 Textiles, clothing and footwear	0	0	0	0	0	0	0	0	0
13 Wood and paper manufacturing	0	0	0	0	0	0	0	0	0
14 Automotive petrol	6.796868	2.8746083	2.8877102	1.1109	1.239817	0	0.1523	0.22792	15.29
15 Chemicals, petroleum and coal products nec	0	0	0	0	0	0	0	0	0
16 Non-metallic mineral products	0	0	0	0	0	0	0	0	0
17 Metals, metal products	0	0	0	0	0	0	0	0	0
18 Machinery appliances and equipment	0	0	0	0	0	0	0	0	0
19 Miscellaneous manufacturing	0	0	0	0	0	0	0	0	0
20 Electricity supply, gas and water	0	0	0	0	0	0	0	0	0
21 Residential building construction	0	0	0	0	0	0	0	0	0
22 Other construction	0	0	0	0	0	0	0	0	0
23 Rail transport	6.564788	3.3373216	3.491268	0.9535	1.577453	0	0.3655	0.305	16.595
24 Taxi transport	7.546382	3.8505273	3.9330241	1.1942	1.628025	0	0.4203	0.26302	18.835
25 Other road transport	12.25661	6.3230091	5.4720753	1.4044	2.195803	0	0.8952	0.34239	28.89
26 Air, water and other transport	129.7731	67.115654	76.992706	23.843	38.74988	0	6.1427	7.461	350.08
27 Transport equipment rental	11.03874	6.114524	5.7763573	1.9374	2.806649	0	0.2806	0.3813	28.336
28 Travel agency and information centre services	42.5303	24.454377	26.105452	9.1339	12.37059	0	1.1531	1.10562	116.92
29 Accommodation	101.1065	41.468466	42.130298	10.537	15.40577	0	3.0954	2.48395	216.23
30 Cafes, restaurants and take-away foods	106.6645	47.48859	44.457594	13.223	17.84878	0	2.4784	2.03277	234.19
31 Wholesale and retail trade	76.55702	35.31987	32.73929	9.9358	11.46458	0	1.8734	1.58705	169.48
32 Ownership of dwellings	37.44043	17.655804	13.6442	6.83	6.588602	0	0.8427	0.37074	83.372
33 Cultural and recreational services;	91.14802	45.634966	43.348804	10.501	15.78521	0	2.3037	2.33324	211.06
34 Communication services	0	0	0	0	0	0	0	0	0
35 Finance, property and other business services	0	0	0	0	0	0	0	0	0
36 Government administration and defence	0	0	0	0	0	0	0	0	0
37 Education and training	66.15696	37.405787	20.573604	5.6366	7.902119	0	2.1422	0.77821	140.6
38 Health and community services	0	0	0	0	0	0	0	0	0
39 Personal and other services	0	0	0	0	0	0	0	0	0

Table SI 2.3 Event matrix for direct losses (proportionate losses for each sector/region), exclusive of infrastructure damages

	NSW	VIC	QLD	SA	WA	TAS	ACT	NT
1 Grapes - wine	0	0	0	0	0	0	0	0
2 Apples, pears & stone fruit	0	0	0	0	0	0	0	0
3 Livestock	0	0	0	0	0	0	0	0
4 Other agriculture	0	0	0	0	0	0	0	0
5 Forestry	0	0	0	0	0	0	0	0
6 Fishing and seafood	0	0	0	0	0	0	0	0
7 Coal, oil and gas	0	0	0	0	0	0	0	0
8 Non-ferrous metal ores	0	0	0	0	0	0	0	0
9 Other mining	0	0	0	0	0	0	0	0
10 Wines	0	0	0	0	0	0	0	0
11 Other food manufacturing	0	0	0	0	0	0	0	0
12 Textiles, clothing and footwear	0	0	0	0	0	0	0	0
13 Wood and paper manufacturing	0	0	0	0	0	0	0	0
14 Automotive petrol	0.002365	0.0012138	0.0015223	0.0064	0.001625	0	0.004	0.00442
15 Chemicals, petroleum and coal products nec	0	0	0	0	0	0	0	0
16 Non-metallic mineral products	0	0	0	0	0	0	0	0
17 Metals, metal products	0	0	0	0	0	0	0	0
18 Machinery appliances and equipment	0	0	0	0	0	0	0	0
19 Miscellaneous manufacturing	0	0	0	0	0	0	0	0
20 Electricity supply, gas and water	0	0	0	0	0	0	0	0
21 Residential building construction	0	0	0	0	0	0	0	0
22 Other construction	0	0	0	0	0	0	0	0
23 Rail transport	0.000733	0.0011227	0.0005456	0.0015	0.001143	0	0.0051	0.00189
24 Taxi transport	0.008861	0.0051247	0.0065402	0.0055	0.004064	0	0.0064	0.0049
25 Other road transport	0.000648	0.0003801	0.0004176	0.0003	0.000282	0	0.0018	0.00065
26 Air, water and other transport	0.003524	0.002405	0.003727	0.0047	0.00349	0	0.0057	0.0068
27 Transport equipment rental	0.014355	0.0190034	0.0123447	0.0115	0.011809	0	0.0056	0.0062
28 Travel agency and information centre services	0.009508	0.0100855	0.0098049	0.0137	0.00849	0	0.0091	0.0026
29 Accommodation	0.017446	0.0125101	0.0094628	0.0116	0.006076	0	0.0178	0.00587
30 Cafes, restaurants and take-away foods	0.004638	0.0027088	0.0032629	0.0028	0.002527	0	0.0022	0.003
31 Wholesale and retail trade	0.000763	0.0004363	0.0005862	0.0005	0.000392	0	0.0005	0.00066
32 Ownership of dwellings	0.000483	0.0004466	0.0003447	0.0005	0.000268	0	0.0001	0.00011
33 Cultural and recreational services;	0.004819	0.0036261	0.0046801	0.0045	0.00451	0	0.0021	0.00319
34 Communication services	0	0	0	0	0	0	0	0
35 Finance, property and other business services	0	0	0	0	0	0	0	0
36 Government administration and defence	0	0	0	0	0	0	0	0
37 Education and training	0.001502	0.0010418	0.0008672	0.0007	0.000563	0	0.0008	0.00053
38 Health and community services	0	0	0	0	0	0	0	0
39 Personal and other services	0	0	0	0	0	0	0	0

Table SI 2.4 Event matrix for capital damages, following the approach detailed by Faturay et al., (2020, p. 69). This infrastructure gamma is added to the matrix for direct losses (SI 2.3) to arrive at the final gamma matrix (γ) that is inclusive of capital losses and direct losses (main paper, Table 1).

	NSW	VIC	QLD	SA	WA	TAS	ACT	NT
1 Grapes - wine	0	0	0	0	0	0	0	0
2 Apples, pears & stone fruit	0	0	0	0	0	0	0	0
3 Livestock	0	0	0	0	0	0	0	0
4 Other agriculture	0	0	0	0	0	0	0	0
5 Forestry	0	0	0	0	0	0	0	0
6 Fishing and seafood	0	0	0	0	0	0	0	0
7 Coal, oil and gas	0	0	0	0	0	0	0	0
8 Non-ferrous metal ores	0	0	0	0	0	0	0	0
9 Other mining	0	0	0	0	0	0	0	0
10 Wines	0	0	0	0	0	0	0	0
11 Other food manufacturing	0	0	0	0	0	0	0	0
12 Textiles, clothing and footwear	0	0	0	0	0	0	0	0
13 Wood and paper manufacturing	0	0	0	0	0	0	0	0
14 Automotive petrol	0	0	0	0	0	0	0	0
15 Chemicals, petroleum and coal products nec	0	0	0	0	0	0	0	0
16 Non-metallic mineral products	0	0	0	0	0	0	0	0
17 Metals, metal products	0	0	0	0	0	0	0	0
18 Machinery appliances and equipment	0	0	0	0	0	0	0	0
19 Miscellaneous manufacturing	0	0	0	0	0	0	0	0
20 Electricity supply, gas and water	0	0	0	0	0	0	0	0
21 Residential building construction	0	0	0	0	0	0	0	0
22 Other construction	0	0	0	0	0	0	0	0
23 Rail transport	0	0	0	0	0	0	0	0
24 Taxi transport	0	0	0	0	0	0	0	0
25 Other road transport	0	0	0.0012974	0	0	0	0	0
26 Air, water and other transport	0	0	0	0	0	0	0	0
27 Transport equipment rental	0	0	0	0	0	0	0	0
28 Travel agency and information centre services	0	0	0	0	0	0	0	0
29 Accommodation	0	0	0.0010878	0.0101	0	0	0	0
30 Cafes, restaurants and take-away foods	0	0	0	0	0	0	0	0
31 Wholesale and retail trade	0	0	0	0	0	0	0	0
32 Ownership of dwellings	0	0	0	0	0	0	0	0
33 Cultural and recreational services;	0.003429	0.0006338	2.977E-05	0.0036	0	0	0	0
34 Communication services	0	0	0	0	0	0	0	0
35 Finance, property and other business services	0	0	0	0	0	0	0	0
36 Government administration and defence	0	0	0	0	0	0	0	0
37 Education and training	0	0	0	0	0	0	0	0
38 Health and community services	0	0	0	0	0	0	0	0
39 Personal and other services	0	0	0	0	0	0	0	0

Table SI 2.5 Summary of Impact information (for calculations including breakdown into sectors and regions see SI 2.7)

Aspect	Region	Sectors	Example impact	Reference
Tourism	-	Multiple	TRA survey data showed that over the March quarter internationally, 4% made changes to their travel itinerary/destinations visited because of the bushfires (a total of 14% reported their trip was impacted in some way by the bushfires, including shortening their trip). For Australian residents, 13% were impacted in some way, with 41% of those cancelling their trips or going overseas instead.	(Personal communication, June 10, 2022) (Personal communication, June 14, 2022)

Table SI 2.6 Summary of infrastructure damage

Aspect	Regions most impacted	Sectors	Major infrastructure (buildings, roads, transport) impacts	Reference
Parks-based recreation	NSW - Northern, Southern, South West National Parks Statewide	Cultural and recreational services	- Crown Lands: Tracks impacted - Six Foot Track, Great North Walk, Hume and Hovell Track; Zig-Zag Railway near Lithgow severely impacted, with destruction to heritage railway lines, buildings and trains - National Parks: 230 visitor precincts impacted, with a range of destroyed assets (including toilets, shelters, BBQs) Estimated AU\$203.11 million	(Infrastructure NSW, 2020)
Cultural artefacts	NSW - Northern, Southern, South West	Cultural and recreational services	24 Aboriginal Land Council and Aboriginal Communities sites impacted Pending cost assessment at time of report	(Infrastructure NSW, 2020)
Other recreation	NSW – Snowy Valleys	Accommodation	Selwyn Snow Resort destroyed Cost unknown	Multiple reports

Parks-based recreation	VIC - Unspecified/Statewide	Cultural and recreational services	Damage to buildings and infrastructure owned by Parks Victoria At least \$30 million	(Bushfire Recovery Victoria, 2020), p. 10)
Parks-based recreation	SA - Kangaroo Island	Cultural and recreational services	98% of Flinders Chase National Park and Kelly Hill Conservation Park lost Infrastructure damage: \$41 million	(State Disaster Recovery, 2020, p. iii)
Holidays/hiking	SA - Kangaroo Island	Accommodation	Rebuild of Southern Ocean Lodge \$50 million	(Boisvert, 2022, para. 4)
Holidays/hiking	QLD – Scenic Rim/Lamington National Park/Southern QLD	Accommodation	In UNESCO-listed Gondwana rainforest near Brisbane, the historic Binna Burra Lodge and cabins were destroyed) \$18 million from the State Government to help rebuild the Lodge	(Queensland Treasury, 2022, p. 11)
Parks-based recreation	QLD – Scenic Rim/Lamington National Park	Cultural and recreational services	35km of walking tracks damaged \$1million grant for remediation works to re-open the tracks	(Queensland Reconstruction Authority, 2020, p. 14) (Queensland Government, 2020, para. 15)
Roads	QLD – Scenic Rim/Lamington National Park	Other road transport	The cliff-side Binna Burra Road was reconstructed over almost one year \$35 million project estimate	(Huxley, 2020) (Binna Burra, 2022)

SI 2.7 Calculations for the gamma matrix (γ)

Tourism losses attributed to the bushfires occurred in the January-March 2020 quarter but this period also coincided with COVID-19, when Australia started closing its international borders to select countries, culminating in a comprehensive shutdown on 20 March (Commonwealth of Australia, 2021). Calculations had to be made about losses attributed to the fires as well as to regions and sectors, from the International Visitor Survey (IVS) and National Visitor Survey (NVS) information, for the event 'gamma' (γ) matrix.

Aggregate losses in international and domestic tourism expenditure

Percentage losses for the quarter were derived from Tourism Research Australia's "Bush fires March quarter 2020" surveys, which TRA provided on request for the National Visitor Survey (NVS) (personal communication, June 14, 2022) and International Visitor Survey (IVS) (personal communication, June 10, 2022). Only data for this quarter was used because, although significant fires began in September 2019 in Queensland, tourism spend through to December 2019 by Australians continued to increase (Tourism Research Australia, 2020b) and for international visitors, spend also increased in Queensland (Tourism Research Australia, 2020a).

The bushfire questions in the survey took place from 21 January-15 March and respondents were asked about changes already realised (i.e., from Christmas 2019) and until the end of 2020 in terms of future trips planned for 2020. To avoid value judgements about how behaviour may have changed after the borders closed to all countries because of COVID-19, no adjustment was made to the Tourism Research Australia survey findings from a particular date. However, for NVS, only figures were used for trips entirely cancelled, not trips cut short, because of a lack of data about the length of shortened trips. For IVS, "changes to travel itinerary/destinations visited" was used as the proxy inbound tourism expenditure losses rather cancellations because IVS data is gathered from international visitors at airports when they exit Australia, meaning that IVS is unable to capture international visitors who have cancelled their trip to Australia because of the bushfires (since these visitors will not show up at airports in Australia, they therefore cannot be included in the IVS).

NOTE: Tourism Research Australia provided not only expenditure on overnight stays but also for day-trips for this study, so these figures will vary from the published NVS and IVS figures that include overnight trips only.

Sectoral and regional calculations

To disaggregate the tourism losses into sectors, categories were brought across from Australia's State Tourism Satellite Accounts (TSA), with minor modifications in terms of aggregation/disaggregation of some sectors. The bushfire tourism losses for the NVS and IVS were calculated separately and then added together for each region before being apportioned to the sectors for each region. Detail about the various calculations from the NVS, IVS and TSA data are below.

Domestic tourists—NVS

Of the 13% impacted by the fires in the March quarter, ~41% of these cancelled their Australian trips or went overseas and we only include 75% of those surveyed, who said those losses were already realised, in order to calculate the losses for the March quarter (and after this time, most tourism losses would be because of the COVID-19 lockdown); the total change in spend by Australians for the quarter attributed to the fires is therefore 4% ($.13 * .75 * .41$). This loss percentage is applied to the summation of totals for 2019 domestic overnight and day trips of \$26.029 billion, from NSW data

provided by TRA (personal communication, August 31, 2022), amounting to \$1.043 billion loss from the fires in domestic tourism. This loss was then allocated between the regions according to each region's proportionate representation of the total NVS quarterly losses.

NOTE: the survey in early 2020 included trips cancelled before the survey because of the bushfires ("i.e. since Christmas"), meaning a small proportion of these losses would have been carried across from the previous calendar year. However, we believe our calculations are conservative because we did not include losses that the survey asked would be realised "Between now and end of 2020", nor trips that were "cut short" because of the fires.

International tourism

The 4.1% loss, using as a proxy changes to itineraries/destinations visited because of the fires, is applied to the March 2019 quarter expenditure provided by TRA (personal communication, August 31, 2022), of \$14.5 billion. This amounted to \$.587 billion international tourism losses from the bushfires in the March 2020 quarter, which was then allocated between the regions according to each region's proportionate representation of the total IVS quarterly losses.

Expenditure unallocated to any regions

"Unallocated" expenditure comprised a minor amount for NVS in 2019 of \$0.087 million, and a significant change for IVS of \$3082m-\$4083m = \$1001.1 million. These were apportioned across the regions by first obtaining the proportionate contribution of each region for NVS and IVS (excluding "Unallocated"), then adding the unallocated amounts according to the region's contribution generally and calculating the proportions again, inclusive of "Unallocated".

Tourism sectors

To assign State/Territory tourism losses totalling \$1.630 billion for IVS+NVS to sectors, category representation in the State Tourism Satellite Accounts is generally mirrored (Austrade & Tourism Research Australia, 2021). Some sector aggregation and disaggregation had to be performed; the TSA's cultural, amusement, sporting and other recreation sectors were amalgamated into this study's "Cultural and recreational services" category, while "All other industries", which is not tourism-specific, was excluded as a separate category, with tourism sector expenditure adjusted accordingly to ensure the total remained the same. Each region's proportionate contribution of each sector was calculated. The tourism-connected industry "Automotive fuel retailing" was split into the study categories of [retail/wholesale] "Trade" and "Automotive petrol" in the proportions 14:86 according to the input-output tables (Australian Bureau of Statistics, 2022) Table 4 proportions of final uses for Petroleum and coal product manufacturing (row 39) for "margin" \$4935 million and "purchaser's prices" \$29439 million (columns AK and AL respectively); therefore the margin is $4935/(4935+29439) \sim 14\%$ and the purchaser's price proportion is $(29439/29439+4935)/ \$29439 \sim 86\%$.

NOTE: The proportionate representation of the year prior to the fires, 2018-19 was used to calculate the sectoral proportionate representation (Austrade & Tourism Research Australia, 2020), since the 2019-20 TSA data are likely to have been significantly impacted by the COVID-19 pandemic expenditure patterns, in particular from the time Australia comprehensively closed its borders to international travel on 20 March 2020. The 2019-20 tourism losses are then adjusted, based on the 2018-19 sector ratios.

Infrastructure losses

Only damage to infrastructure that could be considered a tourism asset was included. For example, Parks infrastructure within National Parks as well as accommodation was included, as was the Binna Burra Road leading to Binna Burra Lodge, which needed to be reconstructed, within Queensland's Lamington National Park. This decision was based on the definition of tourism: "Tourism comprises the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes" (Australian Bureau of Statistics, 1999, para. 3). However, the extensive damage to NSW and Victorian roads and rail was excluded; for example, the Blue Mountains rail line, where fires burnt approximately 82% of the World Heritage park. The reasoning behind this is that these assets would be used in large part by people for day-to-day activities unrelated to tourism.

Depreciation of the productive portion was applied in the same manner as outlined by Lenzen et al. (2019, p. 141) and utilised by Faturay et al. (2020, p. 69). Put simply, the approach to construct the capital damages gamma (γ) for infrastructure losses as a proportion of pre-fire productive capital is:

1. Annualise the loss, e.g., divide the loss figure by 25.
2. Calculate the ratio g , as mentioned in Faturay et al. for the industrial output of a sector enabled by the input of fixed capital, which is: total output (x) for a sector divided by the gross operating surplus for the sector.
3. Multiply the answers from (1) and (2).
4. Divide the answer in (3) by the total output (x).

This capital damages event matrix is added to the direct losses gamma, so that the final event matrix includes both 'direct' and 'capital damages' components.

SI 3 Testing the model

Different scenarios modelled

To check the robustness of the disaster assessment's overall aggregated results (losses in total output and final demand), we modelled four different scenarios, including drawing on stocks and imports from the pre-catastrophe MRIO as a buffer for the losses. The four scenarios tested were: 1. No stocks or imports added; 2. Stocks added where required (where stocks < 0); 3. Stocks plus imports added where required; 4. Stocks plus mirrored imports irrespective of stock losses. These tests changed the aggregated losses in total output and final demand by less than 1%, despite the significantly different scenarios modelled, indicating our results are robust. Our final results did not include reliance on any added stocks or imports.

Sensitivity testing

The sensitivity of the disaster assessment was also checked by executing and plotting the footprint at 1:100% of the losses (gamma matrix losses on the diagonal - ($\hat{\gamma}$)). As can be seen in Figure 1, this showed that the results remained linear, as expected.

Figure 1

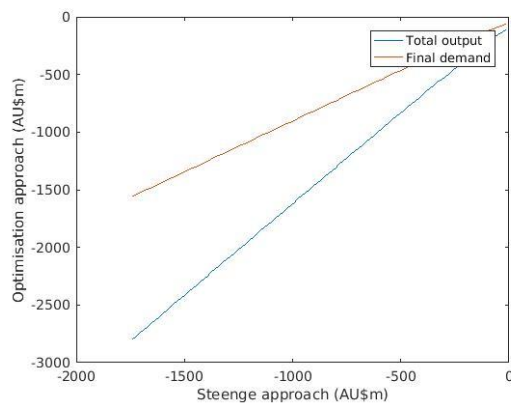
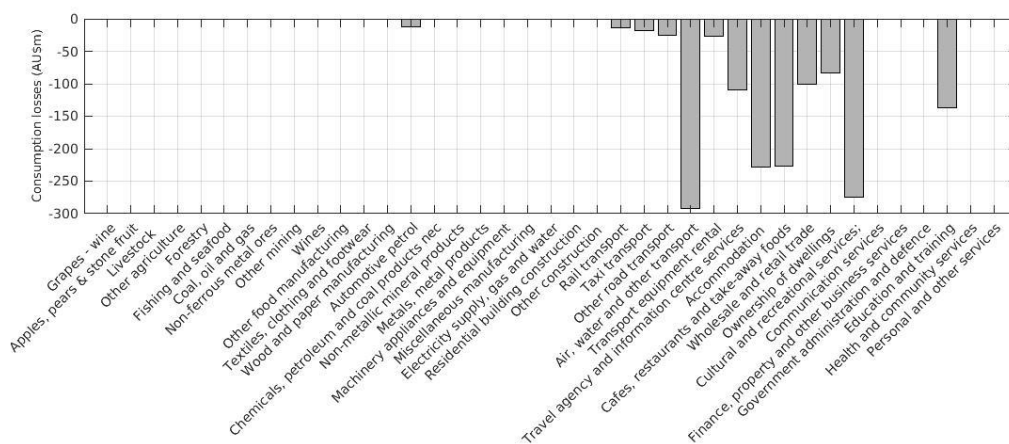


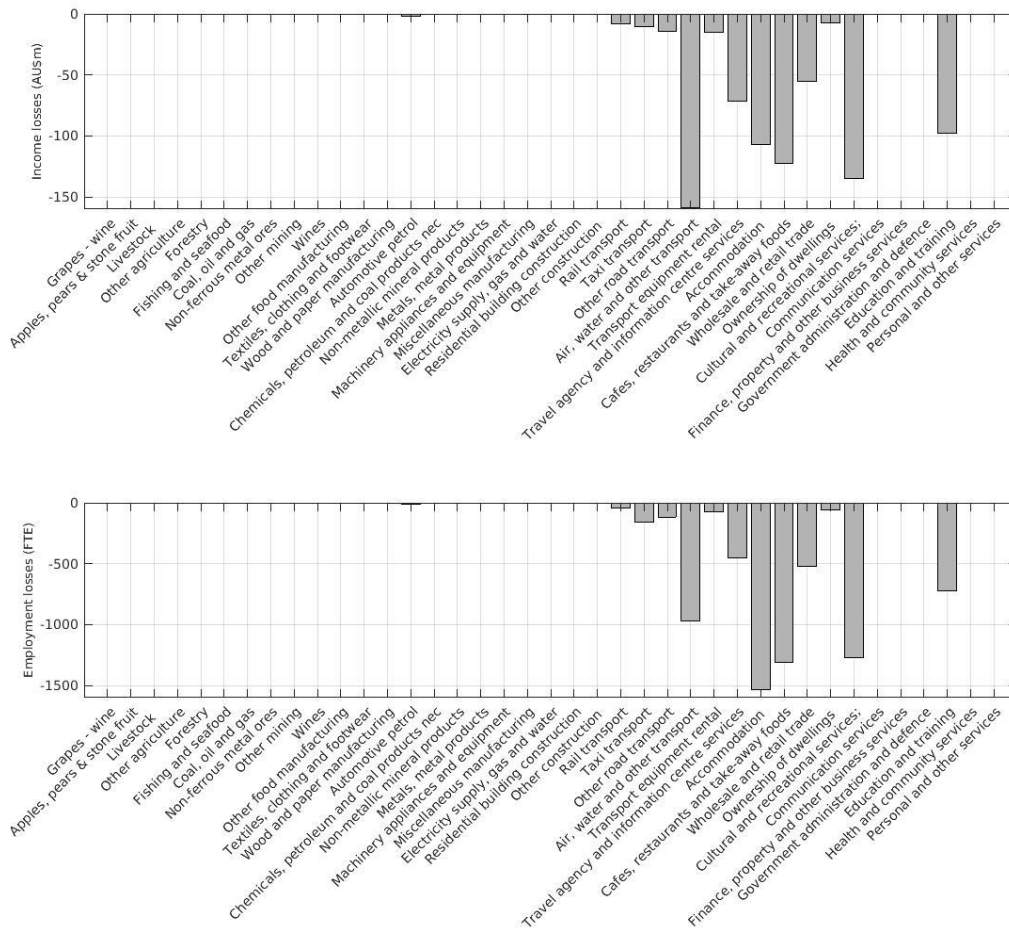
Fig. 1 Total output and final demand at 1:100% gamma ($\hat{\gamma}$) at 1% increments, comparing the Steenge approach, which is always linear, with the optimisation approach.

Fig. 1 shows the model is robust. Linear results are expected with the Steenge approach, which can include negative values in final demand. In the disaster model developed by Faturay et al (2020), which we use, the optimisation approach kicks in if there are negative values in the final demand block ($\mathbf{y}$); this was the case with our study. With the optimisation approach, non-linear, undesirable results may theoretically be possible if proportionate losses in the gamma matrix are too large. However, our testing of the gamma matrix ($\hat{\gamma}$) plotting results using the Steenge and optimisation approaches variously, confirms that our results are clearly linear and therefore robust.

SI 4 National and regional losses

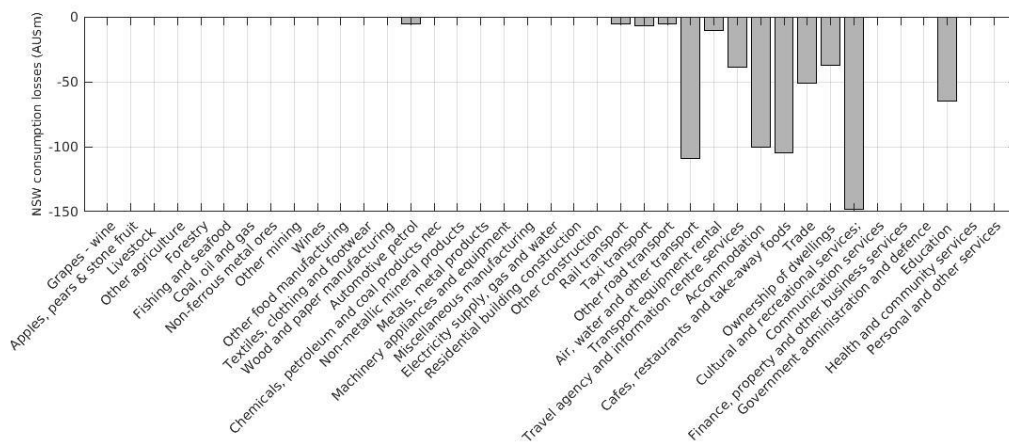
SI 4.1 National losses for consumption, income and employment across the 39 study sectors

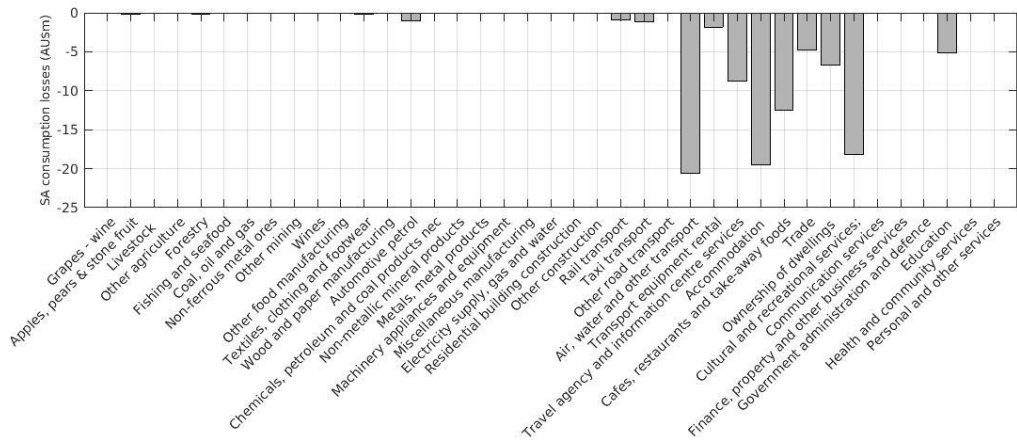
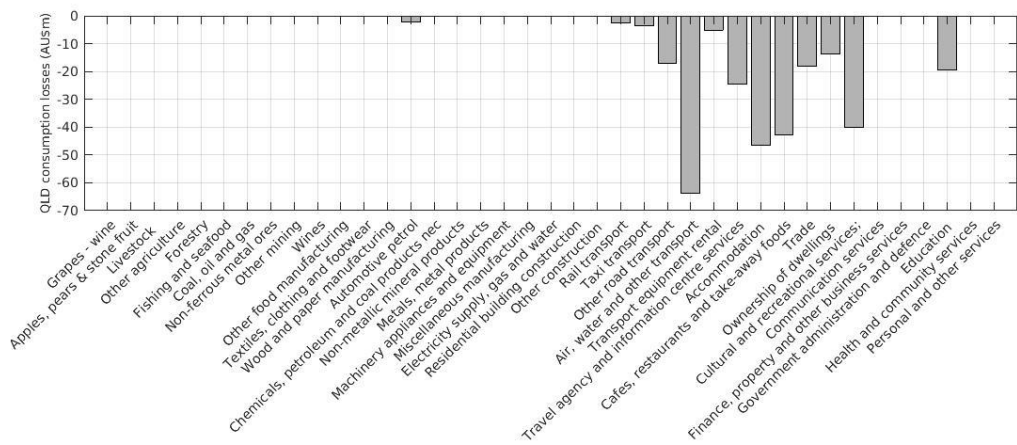
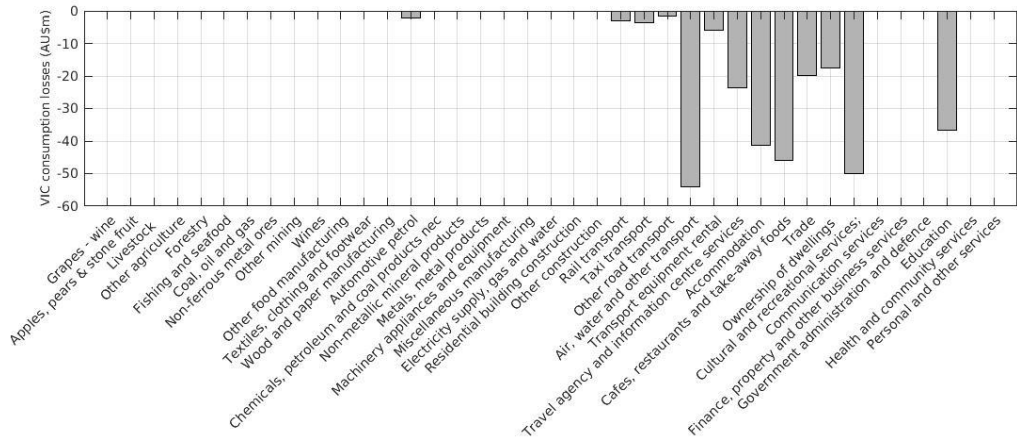


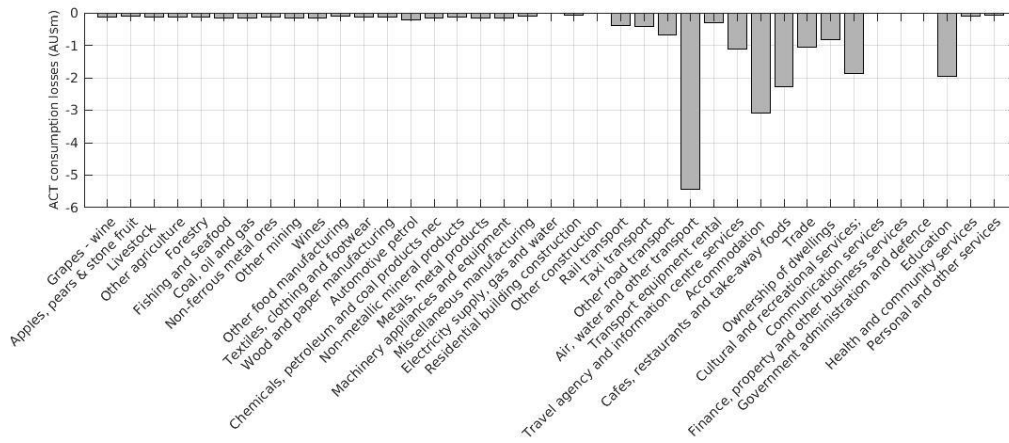
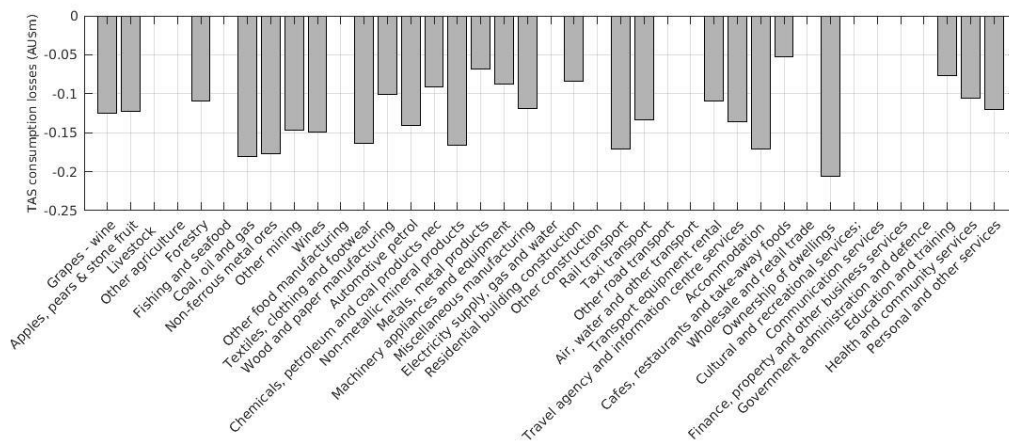
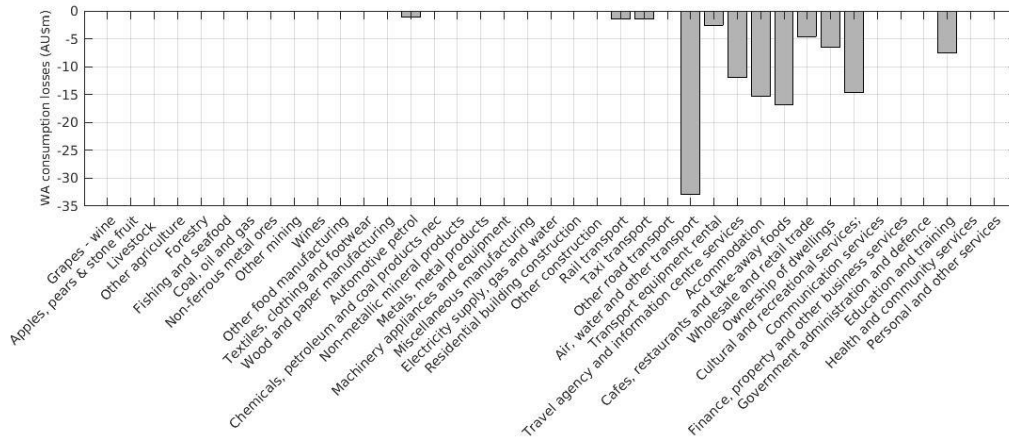


Consumption (final demand), income and employment footprints from the tourism impact of Australia's 2019-20 bushfires across the 39 sector groupings selected for this study. Employment losses are measured in terms of full-time equivalent (FTE) jobs.

SI 4.2 Regional consumption losses across the 39 sectors







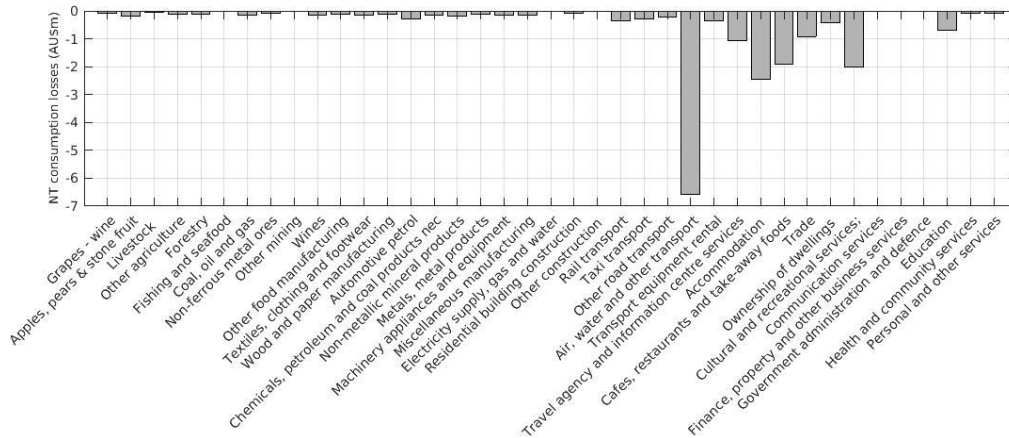
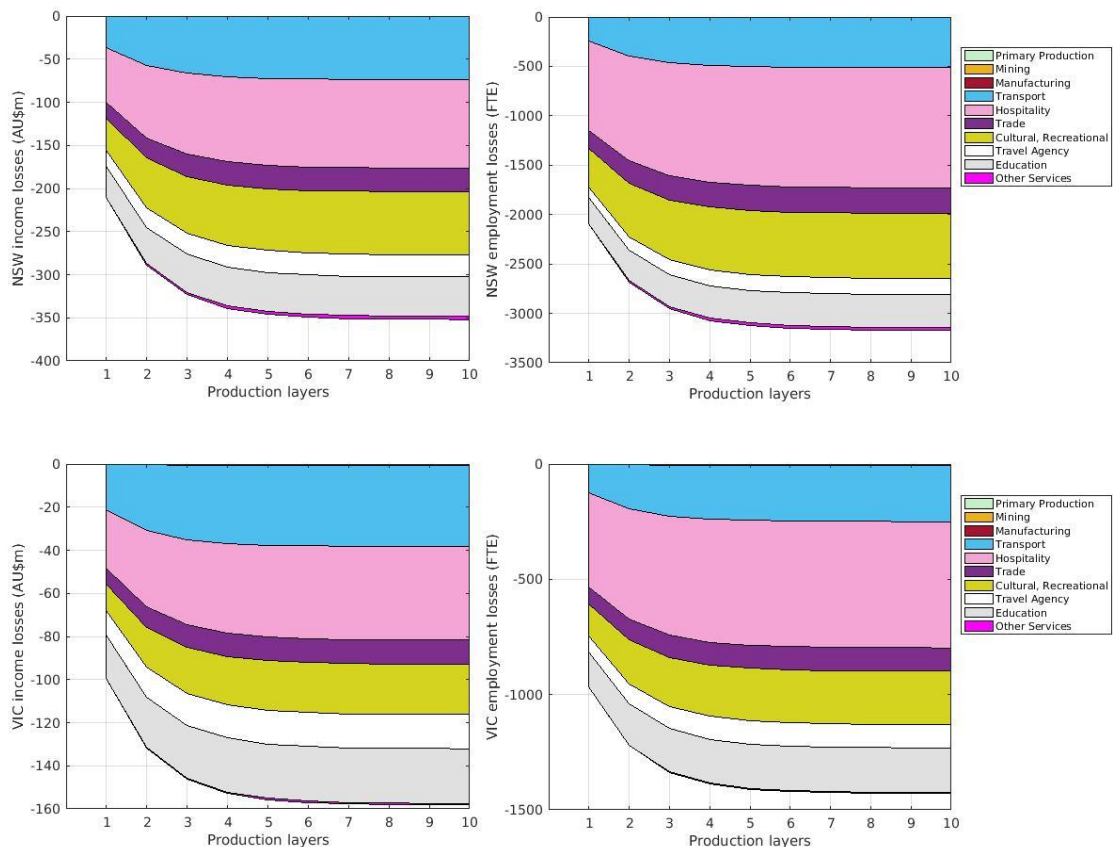
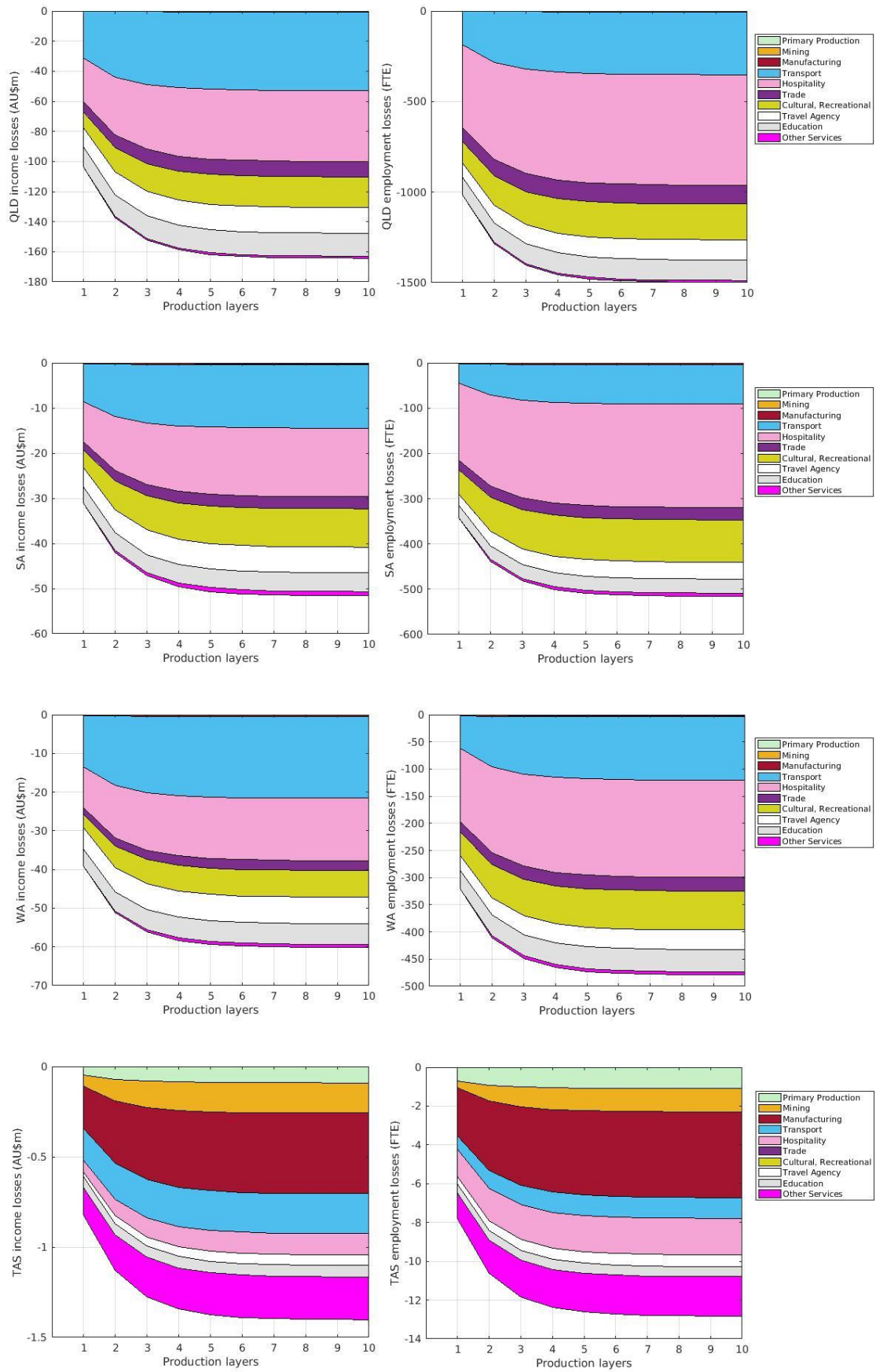


Fig. SI 4.1 Reduction in consumption (AU\$ million), for Australia's 8 States and Territories across each of the 39 sectors used for this study of the cost of the tourism shutdown from the 2019-20 bushfires. Here we focus on contractions in consumption because consumption directly impacts income and employment. The reduction particularly in primary production in some regions is so small that it is difficult to see; the underlying data is in SI 5. Regional abbreviations: New South Wales (NSW); Victoria (VIC); Queensland (QLD); South Australia (SA); Western Australia (WA); Tasmania (TAS); Australian Capital Territory (ACT); Northern Territory (NT).

SI 4.3: Regional production layer decomposition (PLD) for income and employment in broad sector groupings





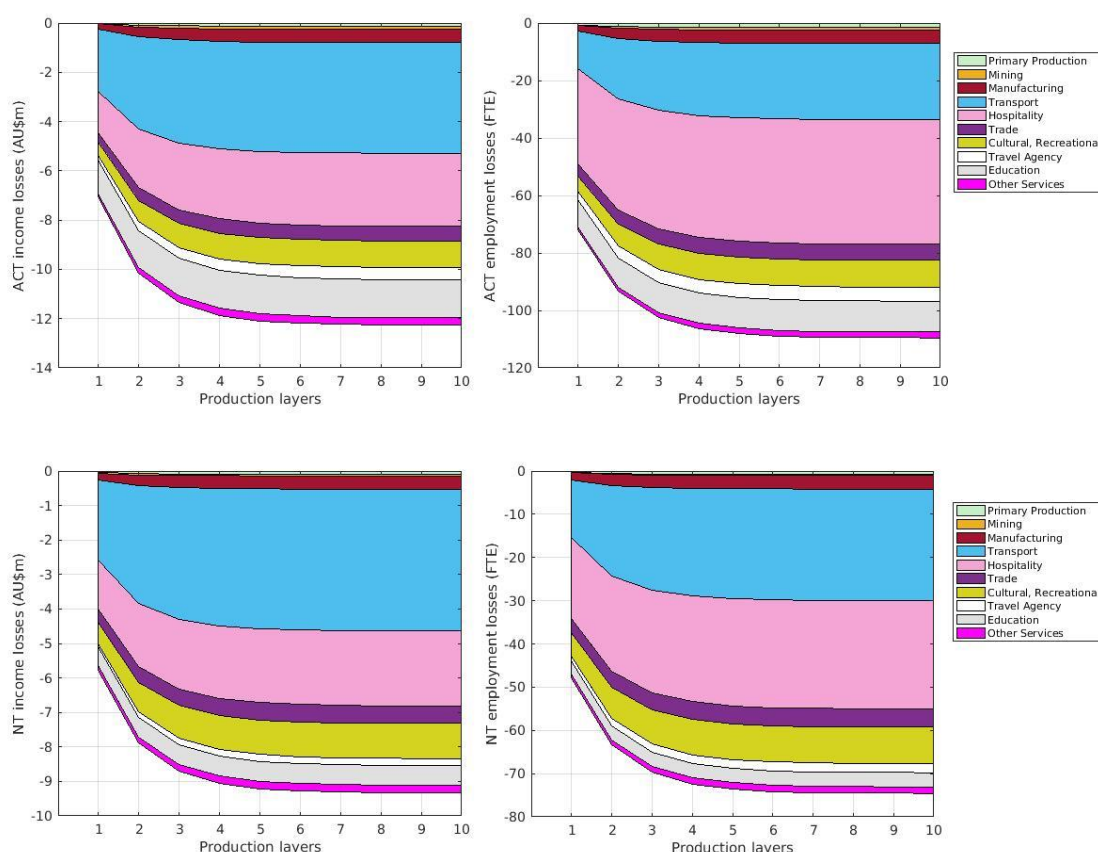


Fig. SI 4.2 Production layer decomposition (PLD) of the reduction in income and employment for 10 broad sector groupings in each of Australia's States and Territories. Layer 1 represents losses from the direct tourism damages, layer 2 is the cumulative losses including direct suppliers and so on, up to 10 layers of production, which comprise the bulk of the losses. Regional abbreviations: New South Wales (NSW); Victoria (VIC); Queensland (QLD); South Australia (SA); Western Australia (WA); Tasmania (TAS); Australian Capital Territory (ACT); Northern Territory (NT).

SI 5 Underlying data for figures

Region	Sector	Consumption (AU\$m)	Income (AU\$m)	Employment (FTE)
NSW	Grapes - wine	-0.135	-0.052	-0.973
NSW	Apples, pears & stone fruit	-0.127	-0.045	-0.446
NSW	Livestock	0.000	0.000	0.000
NSW	Other agriculture	0.000	0.000	0.000
NSW	Forestry	-0.102	-0.036	-0.336
NSW	Fishing and seafood	0.000	0.000	0.000
NSW	Coal, oil and gas	0.000	0.000	0.000
NSW	Non-ferrous metal ores	-0.153	-0.056	-0.492
NSW	Other mining	-0.072	-0.021	-0.147
NSW	Wines	0.000	0.000	0.000
NSW	Other food manufacturing	0.000	0.000	0.000
NSW	Textiles, clothing and footwear	-0.073	-0.030	-0.434
NSW	Wood and paper manufacturing	0.000	0.000	0.000
NSW	Automotive petrol	-5.769	-0.800	-5.181

NSW	Chemicals, petroleum and coal products nec	0.000	0.000	0.000
NSW	Non-metallic mineral products	0.000	0.000	0.000
NSW	Metals, metal products	0.000	0.000	0.000
NSW	Machinery appliances and equipment	0.000	0.000	0.000
NSW	Miscellaneous manufacturing	0.000	0.000	0.000
NSW	Electricity supply, gas and water	0.000	0.000	0.000
NSW	Residential building construction	0.000	0.000	0.000
NSW	Other construction	0.000	0.000	0.000
NSW	Rail transport	-5.479	-3.120	-17.008
NSW	Taxi transport	-7.246	-4.076	-70.175
NSW	Other road transport	-5.524	-2.866	-25.217
NSW	Air, water and other transport	-109.250	-57.050	-365.650
NSW	Transport equipment rental	-10.357	-5.442	-28.927
NSW	Travel agency and information centre services	-38.890	-25.625	-160.730
NSW	Accommodation	-100.620	-46.061	-632.620
NSW	Cafes, restaurants and take-away foods	-104.440	-56.870	-581.730
NSW	Wholesale and retail trade	-51.355	-27.425	-258.480
NSW	Ownership of dwellings	-37.356	-3.777	-28.126
NSW	Cultural and recreational services;	-148.330	-73.235	-661.620
NSW	Communication services	0.000	0.000	0.000
NSW	Finance, property and other business services	0.000	0.000	0.000
NSW	Government administration and defence	0.000	0.000	0.000
NSW	Education and training	-64.995	-45.527	-332.280
NSW	Health and community services	0.000	0.000	0.000
NSW	Personal and other services	0.000	0.000	0.000
VIC	Grapes - wine	-0.114	-0.041	-0.646
VIC	Apples, pears & stone fruit	-0.056	-0.020	-0.175
VIC	Livestock	0.000	0.000	0.000
VIC	Other agriculture	0.000	0.000	0.000
VIC	Forestry	-0.136	-0.054	-0.431
VIC	Fishing and seafood	-0.043	-0.016	-0.077
VIC	Coal, oil and gas	-0.162	-0.041	-0.256
VIC	Non-ferrous metal ores	-0.201	-0.072	-0.650
VIC	Other mining	-0.123	-0.035	-0.249
VIC	Wines	0.000	0.000	0.000
VIC	Other food manufacturing	0.000	0.000	0.000
VIC	Textiles, clothing and footwear	-0.053	-0.021	-0.377
VIC	Wood and paper manufacturing	0.000	0.000	0.000
VIC	Automotive petrol	-2.208	-0.310	-2.158
VIC	Chemicals, petroleum and coal products nec	0.000	0.000	0.000
VIC	Non-metallic mineral products	0.000	0.000	0.000
VIC	Metals, metal products	0.000	0.000	0.000
VIC	Machinery appliances and equipment	0.000	0.000	0.000

VIC	Miscellaneous manufacturing	0.000	0.000	0.000
VIC	Electricity supply, gas and water	0.000	0.000	0.000
VIC	Residential building construction	0.000	0.000	0.000
VIC	Other construction	0.000	0.000	0.000
VIC	Rail transport	-3.039	-1.813	-8.833
VIC	Taxi transport	-3.647	-2.133	-33.249
VIC	Other road transport	-1.476	-0.812	-6.627
VIC	Air, water and other transport	-53.984	-29.515	-177.060
VIC	Transport equipment rental	-5.987	-3.435	-18.846
VIC	Travel agency and information centre services	-23.531	-15.755	-101.880
VIC	Accommodation	-41.217	-19.057	-279.360
VIC	Cafes, restaurants and take-away foods	-45.918	-24.328	-268.460
VIC	Wholesale and retail trade	-19.984	-11.149	-100.650
VIC	Ownership of dwellings	-17.541	-0.659	-5.385
VIC	Cultural and recreational services;	-49.864	-23.466	-231.440
VIC	Communication services	0.000	0.000	0.000
VIC	Finance, property and other business services	0.000	0.000	0.000
VIC	Government administration and defence	0.000	0.000	0.000
VIC	Education and training	-36.626	-25.448	-193.360
VIC	Health and community services	0.000	0.000	0.000
VIC	Personal and other services	0.000	0.000	0.000
QLD	Grapes - wine	-0.121	-0.038	-0.660
QLD	Apples, pears & stone fruit	-0.133	-0.045	-0.448
QLD	Livestock	0.000	0.000	0.000
QLD	Other agriculture	0.000	0.000	0.000
QLD	Forestry	-0.138	-0.053	-0.414
QLD	Fishing and seafood	0.000	0.000	0.000
QLD	Coal, oil and gas	0.000	0.000	0.000
QLD	Non-ferrous metal ores	0.000	0.000	0.000
QLD	Other mining	0.000	0.000	0.000
QLD	Wines	-0.141	-0.012	-0.202
QLD	Other food manufacturing	0.000	0.000	0.000
QLD	Textiles, clothing and footwear	-0.120	-0.052	-0.754
QLD	Wood and paper manufacturing	0.000	0.000	0.000
QLD	Automotive petrol	-2.116	-0.324	-2.063
QLD	Chemicals, petroleum and coal products nec	0.000	0.000	0.000
QLD	Non-metallic mineral products	0.000	0.000	0.000
QLD	Metals, metal products	0.000	0.000	0.000
QLD	Machinery appliances and equipment	0.000	0.000	0.000
QLD	Miscellaneous manufacturing	0.000	0.000	0.000
QLD	Electricity supply, gas and water	0.000	0.000	0.000
QLD	Residential building construction	0.000	0.000	0.000
QLD	Other construction	0.000	0.000	0.000
QLD	Rail transport	-2.525	-1.523	-7.952

QLD	Taxi transport	-3.700	-2.278	-32.935
QLD	Other road transport	-17.103	-9.808	-79.462
QLD	Air, water and other transport	-63.666	-35.720	-214.190
QLD	Transport equipment rental	-5.360	-3.039	-12.948
QLD	Travel agency and information centre services	-24.617	-17.072	-110.990
QLD	Accommodation	-46.451	-23.423	-350.010
QLD	Cafes, restaurants and take-away foods	-42.688	-23.791	-260.150
QLD	Wholesale and retail trade	-18.259	-10.149	-104.040
QLD	Ownership of dwellings	-13.567	-1.347	-10.796
QLD	Cultural and recreational services;	-40.111	-20.423	-198.140
QLD	Communication services	0.000	0.000	0.000
QLD	Finance, property and other business services	0.000	0.000	0.000
QLD	Government administration and defence	0.000	0.000	0.000
QLD	Education and training	-19.601	-15.231	-112.900
QLD	Health and community services	0.000	0.000	0.000
QLD	Personal and other services	0.000	0.000	0.000
SA	Grapes - wine	-0.039	-0.011	-0.225
SA	Apples, pears & stone fruit	-0.134	-0.038	-0.385
SA	Livestock	0.000	0.000	0.000
SA	Other agriculture	0.000	0.000	0.000
SA	Forestry	-0.157	-0.058	-0.475
SA	Fishing and seafood	0.000	0.000	0.000
SA	Coal, oil and gas	0.000	0.000	0.000
SA	Non-ferrous metal ores	-0.119	-0.051	-0.462
SA	Other mining	-0.030	-0.011	-0.078
SA	Wines	0.000	0.000	0.000
SA	Other food manufacturing	0.000	0.000	0.000
SA	Textiles, clothing and footwear	-0.151	-0.072	-1.007
SA	Wood and paper manufacturing	0.000	0.000	0.000
SA	Automotive petrol	-1.075	-0.149	-0.672
SA	Chemicals, petroleum and coal products nec	0.000	0.000	0.000
SA	Non-metallic mineral products	-0.092	-0.043	-0.370
SA	Metals, metal products	0.000	0.000	0.000
SA	Machinery appliances and equipment	0.000	0.000	0.000
SA	Miscellaneous manufacturing	0.000	0.000	0.000
SA	Electricity supply, gas and water	0.000	0.000	0.000
SA	Residential building construction	0.000	0.000	0.000
SA	Other construction	0.000	0.000	0.000
SA	Rail transport	-0.866	-0.485	-2.500
SA	Taxi transport	-1.126	-0.666	-5.938
SA	Other road transport	0.000	0.000	0.000
SA	Air, water and other transport	-20.600	-11.753	-75.162
SA	Transport equipment rental	-1.844	-1.114	-3.540

SA	Travel agency and information centre services	-8.811	-5.724	-37.033
SA	Accommodation	-19.543	-8.727	-147.600
SA	Cafes, restaurants and take-away foods	-12.476	-6.484	-81.089
SA	Wholesale and retail trade	-4.739	-2.656	-27.451
SA	Ownership of dwellings	-6.761	-0.895	-7.428
SA	Cultural and recreational services;	-18.142	-8.524	-93.680
SA	Communication services	0.000	0.000	0.000
SA	Finance, property and other business services	0.000	0.000	0.000
SA	Government administration and defence	0.000	0.000	0.000
SA	Education and training	-5.192	-4.119	-31.215
SA	Health and community services	0.000	0.000	0.000
SA	Personal and other services	0.000	0.000	0.000
WA	Grapes - wine	-0.135	-0.048	-0.868
WA	Apples, pears & stone fruit	-0.141	-0.045	-0.401
WA	Livestock	0.000	0.000	0.000
WA	Other agriculture	0.000	0.000	0.000
WA	Forestry	-0.139	-0.051	-0.353
WA	Fishing and seafood	0.000	0.000	0.000
WA	Coal, oil and gas	0.000	0.000	0.000
WA	Non-ferrous metal ores	0.000	0.000	0.000
WA	Other mining	0.000	0.000	0.000
WA	Wines	-0.067	-0.013	-0.193
WA	Other food manufacturing	0.000	0.000	0.000
WA	Textiles, clothing and footwear	-0.165	-0.062	-0.713
WA	Wood and paper manufacturing	0.000	0.000	0.000
WA	Automotive petrol	-1.036	-0.187	-1.133
WA	Chemicals, petroleum and coal products nec	0.000	0.000	0.000
WA	Non-metallic mineral products	-0.057	-0.023	-0.177
WA	Metals, metal products	0.000	0.000	0.000
WA	Machinery appliances and equipment	0.000	0.000	0.000
WA	Miscellaneous manufacturing	0.000	0.000	0.000
WA	Electricity supply, gas and water	0.000	0.000	0.000
WA	Residential building construction	0.000	0.000	0.000
WA	Other construction	0.000	0.000	0.000
WA	Rail transport	-1.476	-0.733	-2.958
WA	Taxi transport	-1.517	-0.927	-10.678
WA	Other road transport	-0.026	-0.015	-0.105
WA	Air, water and other transport	-32.925	-17.908	-97.613
WA	Transport equipment rental	-2.668	-1.542	-5.190
WA	Travel agency and information centre services	-11.861	-6.863	-36.527
WA	Accommodation	-15.262	-7.217	-79.894
WA	Cafes, restaurants and take-away foods	-16.887	-8.959	-99.356
WA	Wholesale and retail trade	-4.689	-2.530	-25.042

WA	Ownership of dwellings	-6.512	-0.768	-5.908
WA	Cultural and recreational services;	-14.608	-6.919	-71.784
WA	Communication services	0.000	0.000	0.000
WA	Finance, property and other business services	0.000	0.000	0.000
WA	Government administration and defence	0.000	0.000	0.000
WA	Education and training	-7.476	-5.401	-40.376
WA	Health and community services	0.000	0.000	0.000
WA	Personal and other services	0.000	0.000	0.000
TAS	Grapes - wine	-0.125	-0.028	-0.594
TAS	Apples, pears & stone fruit	-0.122	-0.027	-0.248
TAS	Livestock	0.000	0.000	0.000
TAS	Other agriculture	0.000	0.000	0.000
TAS	Forestry	-0.109	-0.035	-0.251
TAS	Fishing and seafood	0.000	0.000	0.000
TAS	Coal, oil and gas	-0.180	-0.041	-0.170
TAS	Non-ferrous metal ores	-0.177	-0.077	-0.691
TAS	Other mining	-0.146	-0.050	-0.344
TAS	Wines	-0.149	-0.036	-0.522
TAS	Other food manufacturing	0.000	0.000	0.000
TAS	Textiles, clothing and footwear	-0.163	-0.087	-0.982
TAS	Wood and paper manufacturing	-0.101	-0.052	-0.469
TAS	Automotive petrol	-0.140	-0.026	-0.104
TAS	Chemicals, petroleum and coal products nec	-0.091	-0.038	-0.259
TAS	Non-metallic mineral products	-0.166	-0.074	-0.610
TAS	Metals, metal products	-0.068	-0.029	-0.257
TAS	Machinery appliances and equipment	-0.088	-0.045	-0.433
TAS	Miscellaneous manufacturing	-0.119	-0.060	-0.787
TAS	Electricity supply, gas and water	0.000	0.000	0.000
TAS	Residential building construction	-0.084	-0.035	-0.437
TAS	Other construction	0.000	0.000	0.000
TAS	Rail transport	-0.171	-0.078	-0.305
TAS	Taxi transport	-0.133	-0.082	-0.585
TAS	Other road transport	0.000	0.000	0.000
TAS	Air, water and other transport	0.000	0.000	0.000
TAS	Transport equipment rental	-0.109	-0.062	-0.177
TAS	Travel agency and information centre services	-0.136	-0.056	-0.600
TAS	Accommodation	-0.171	-0.087	-1.533
TAS	Cafes, restaurants and take-away foods	-0.053	-0.031	-0.356
TAS	Wholesale and retail trade	0.000	0.000	0.000
TAS	Ownership of dwellings	-0.206	-0.031	-0.257
TAS	Cultural and recreational services;	0.000	0.000	0.000
TAS	Communication services	0.000	0.000	0.000
TAS	Finance, property and other business services	0.000	0.000	0.000

TAS	Government administration and defence	0.000	0.000	0.000
TAS	Education and training	-0.076	-0.064	-0.517
TAS	Health and community services	-0.106	-0.093	-0.447
TAS	Personal and other services	-0.120	-0.079	-0.889
ACT	Grapes - wine	-0.120	-0.024	-0.329
ACT	Apples, pears & stone fruit	-0.100	-0.029	-0.179
ACT	Livestock	-0.126	-0.035	-0.614
ACT	Other agriculture	-0.143	-0.023	-0.295
ACT	Forestry	-0.141	-0.013	-0.142
ACT	Fishing and seafood	-0.150	-0.010	-0.075
ACT	Coal, oil and gas	-0.154	-0.011	-0.087
ACT	Non-ferrous metal ores	-0.141	-0.054	-0.415
ACT	Other mining	-0.149	-0.054	-0.386
ACT	Wines	-0.150	-0.037	-0.278
ACT	Other food manufacturing	-0.107	-0.043	-0.460
ACT	Textiles, clothing and footwear	-0.143	-0.067	-0.644
ACT	Wood and paper manufacturing	-0.138	-0.068	-0.651
ACT	Automotive petrol	-0.227	-0.034	-0.103
ACT	Chemicals, petroleum and coal products nec	-0.173	-0.069	-0.411
ACT	Non-metallic mineral products	-0.139	-0.059	-0.521
ACT	Metals, metal products	-0.149	-0.050	-0.447
ACT	Machinery appliances and equipment	-0.163	-0.063	-0.709
ACT	Miscellaneous manufacturing	-0.103	-0.049	-0.464
ACT	Electricity supply, gas and water	0.000	0.000	0.000
ACT	Residential building construction	-0.064	-0.027	-0.266
ACT	Other construction	0.000	0.000	0.000
ACT	Rail transport	-0.390	-0.199	-0.183
ACT	Taxi transport	-0.421	-0.289	-1.941
ACT	Other road transport	-0.689	-0.435	-3.603
ACT	Air, water and other transport	-5.449	-3.370	-20.272
ACT	Transport equipment rental	-0.299	-0.200	-0.368
ACT	Travel agency and information centre services	-1.103	-0.483	-4.812
ACT	Accommodation	-3.079	-1.565	-30.124
ACT	Cafes, restaurants and take-away foods	-2.272	-1.408	-13.266
ACT	Wholesale and retail trade	-1.062	-0.600	-5.561
ACT	Ownership of dwellings	-0.833	-0.141	-1.035
ACT	Cultural and recreational services;	-1.873	-1.078	-9.473
ACT	Communication services	0.000	0.000	0.000
ACT	Finance, property and other business services	0.000	0.000	0.000
ACT	Government administration and defence	0.000	0.000	0.000
ACT	Education and training	-1.963	-1.551	-10.682
ACT	Health and community services	-0.109	-0.091	-0.399
ACT	Personal and other services	-0.066	-0.046	-0.353
NT	Grapes - wine	-0.094	-0.034	-0.213

NT	Apples, pears & stone fruit	-0.188	-0.001	-0.006
NT	Livestock	-0.052	-0.009	-0.153
NT	Other agriculture	-0.117	-0.020	-0.225
NT	Forestry	-0.108	-0.031	-0.210
NT	Fishing and seafood	-0.002	-0.001	-0.003
NT	Coal, oil and gas	-0.156	-0.012	-0.024
NT	Non-ferrous metal ores	-0.085	-0.035	-0.146
NT	Other mining	0.000	0.000	0.000
NT	Wines	-0.140	-0.020	-0.183
NT	Other food manufacturing	-0.106	-0.034	-0.319
NT	Textiles, clothing and footwear	-0.150	-0.043	-0.395
NT	Wood and paper manufacturing	-0.132	-0.037	-0.320
NT	Automotive petrol	-0.282	-0.026	-0.137
NT	Chemicals, petroleum and coal products nec	-0.154	-0.033	-0.201
NT	Non-metallic mineral products	-0.185	-0.059	-0.350
NT	Metals, metal products	-0.132	-0.041	-0.313
NT	Machinery appliances and equipment	-0.149	-0.043	-0.392
NT	Miscellaneous manufacturing	-0.149	-0.050	-0.570
NT	Electricity supply, gas and water	0.000	0.000	0.000
NT	Residential building construction	-0.082	-0.044	-0.360
NT	Other construction	0.000	0.000	0.000
NT	Rail transport	-0.366	-0.085	-0.168
NT	Taxi transport	-0.297	-0.198	-1.158
NT	Other road transport	-0.232	-0.125	-1.045
NT	Air, water and other transport	-6.594	-3.473	-23.047
NT	Transport equipment rental	-0.370	-0.224	-0.502
NT	Travel agency and information centre services	-1.053	-0.198	-2.027
NT	Accommodation	-2.451	-1.166	-15.695
NT	Cafes, restaurants and take-away foods	-1.899	-1.022	-9.308
NT	Wholesale and retail trade	-0.917	-0.504	-4.190
NT	Ownership of dwellings	-0.429	-0.047	-0.360
NT	Cultural and recreational services;	-2.013	-1.020	-8.477
NT	Communication services	-0.011	-0.004	-0.038
NT	Finance, property and other business services	0.000	0.000	0.000
NT	Government administration and defence	0.000	0.000	0.000
NT	Education and training	-0.688	-0.581	-3.302
NT	Health and community services	-0.090	-0.081	-0.354
NT	Personal and other services	-0.071	-0.043	-0.394
Total		-1561.783	-809.432	-7292.336

SI 6 References

- Austrade & Tourism Research Australia (2020) Appendix: State tourism satellite accounts, 2018–19. Commonwealth of Australia, Tourism Research Australia. <https://www.tra.gov.au/en/data-and-research.html>. Accessed 11 September 2023
- Austrade & Tourism Research Australia (2021) Appendix: State tourism satellite accounts, 2019–20. Commonwealth of Australia, Tourism Research Australia. <https://www.tra.gov.au/en/data-and-research.html>. Accessed 11 September 2023
- Australian Bureau of Statistics (1999) 9502.0.55.001 - Framework for Australian Tourism Statistics, 1999. ABS
<https://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/5AA223EA8A78A311CA25697E0018FBFF?opendocument>. Accessed 23 August 2023
- Australian Bureau of Statistics (2022) Australian National Accounts: Input-Output Tables (Product Details) - 2018-19. ABS.
- Binna Burra (2022) QLD Government will provide funding support to rebuild the historic Binna Burra Lodge. Binna Burra Lodge. <https://www.binnaburralodge.com.au/news/qld-government-will-provide-funding-support-to-rebuild-the-historic-binna-burra-lodge/>. Accessed 24 June 2022
- Boisvert, E (2022) Southern Ocean Lodge rebuild on Kangaroo Island starts two years after devastating bushfire. ABC. [https://www.abc.net.au/news/2022-02-18/southern-ocean-lodge-rebuild-on-kangaroo-island-starts/100842806#:~:text=The%20lodge%20was%20destroyed%20in,its%20replacement%2C%20worth%20%2450%20million](https://www.abc.net.au/news/2022-02-18/southern-ocean-lodge-rebuild-on-kangaroo-island-starts/100842806#:~:text=The%20lodge%20was%20destroyed%20in,its%20replacement%2C%20worth%20%2450%20million.). Accessed 24 June 2022
- Bushfire Recovery Victoria (2020) Eastern Victorian fires 2019–20 State Recovery Plan. State of Victoria, Melbourne
- Faturay, F, Sun, Y-Y, Dietzenbacher, E, Malik, A, Geschke, A, Lenzen, M (2020) Using virtual laboratories for disaster analysis: A case study of Taiwan. *Economic Systems Res.*, 32(1):58-83. <https://doi.org/10.1080/09535314.2019.1617677>
- State Disaster Recovery (2020) 2019-20 South Australian bushfire recovery: Interim report. Department of the Premier and Cabinet, Adelaide
- Huxley, J (2020) Binna Burra cliffside road rebuilt after bushfire an 'engineering feat'. ABC. Retrieved 6 July 2022, from <https://www.abc.net.au/news/2020-06-17/binna-burra-road-reconstruction-a-feat-of-engineering/12357354>
- Infrastructure NSW (2020, 9 July) Exhibit: Summary of impacted NSW assets Royal Commission into National Natural Disaster Arrangements, Canberra. Retrieved 19 May 2022, from <https://naturaldisaster.royalcommission.gov.au/publications/exhibit-20-023004-nsw0010010048-annexure-c-nsw-impacted-assets-register-summary-6-june-2020>
- Lenzen, M, Malik, A, Kenway, S, Daniels, P, Ka Leung, L, Geschke, A (2019) Economic damage and spillovers from a tropical cyclone. *Nat. Hazards and Earth System Sciences*, 19(1):137-151. <http://dx.doi.org/10.5194/nhess-19-137-2019>
- Queensland Government (2020) Binna Burra Road reopening marks key recovery milestone [Press release]. <https://statements.qld.gov.au/statements/90603>. Accessed 6 July 2022

Queensland Reconstruction Authority (2020) 2019 Queensland bushfires: State Recovery Plan 2019-2022. State of Queensland, City East

Queensland Treasury (2022) Budget speech: Budget paper No. 1 – 2022–23 Queensland Budget. https://s3.treasury.qld.gov.au/files/Budget_2022-23_Speech.pdf. Accessed 6 July 2022

Tourism Research Australia (2020a) International visitors in Australia: Year ending March 2020 [Summary]. Commonwealth of Australia, Author. <https://www.tra.gov.au/en/data-and-research.html>. Accessed 25 August 2023

Tourism Research Australia (2020b) Travel by Australians: Year ending March 2020 [Summary]. Commonwealth of Australia, Author. <https://www.tra.gov.au/en/data-and-research.html>. Accessed 25 August 2023