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STATISTICAL NEWS

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SEASONALLY ADJUSTED VISITOR ARRIVALS JULY 2019

Seasonal adjustment is the process of estimating and then removing from a time series influences that are systematic and calendar related. Observed data needs to be seasonally adjusted as seasonal effects can hide both the true underlying movement in the series, as well as certain non-seasonal characteristics which may be of interest to analysts. (Refer to "Appendix 1-Explanatory Notes" for a detailed explanation).

VISITOR ARRIVALS TO FIJI

	July 2019	June 2019 to July 2019 % change	July 2018 to July 2019 % change
Total			
Trend	77,263	0.13	4.90
Seasonally Adjusted	75,574	-1.59	…
Original	96,376	…	…
Australia			
Trend	31,583	-0.16	2.53
Seasonally Adjusted	31,550	-0.70	…
Original	36,799	…	…
New Zealand			
Trend	17,855	0.32	5.83
Seasonally Adjusted	16,840	-6.16	…
Original	27,963	…	…
USA			
Trend	8,012	-0.11	10.31
Seasonally Adjusted	7,738	-0.67	…
Original	9,926	…	…
Continental Europe			
Trend	3,177	0.92	0.22
Seasonally Adjusted	3,373	4.04	…
Original	3,541	…	…
Japan			
Trend	1,300	1.40	27.20
Seasonally Adjusted	1,292	10.43	…
Original	1,571	…	…

…not applicable (see notes below and "Appendix 1-Explanatory Notes" for more details)

Note:

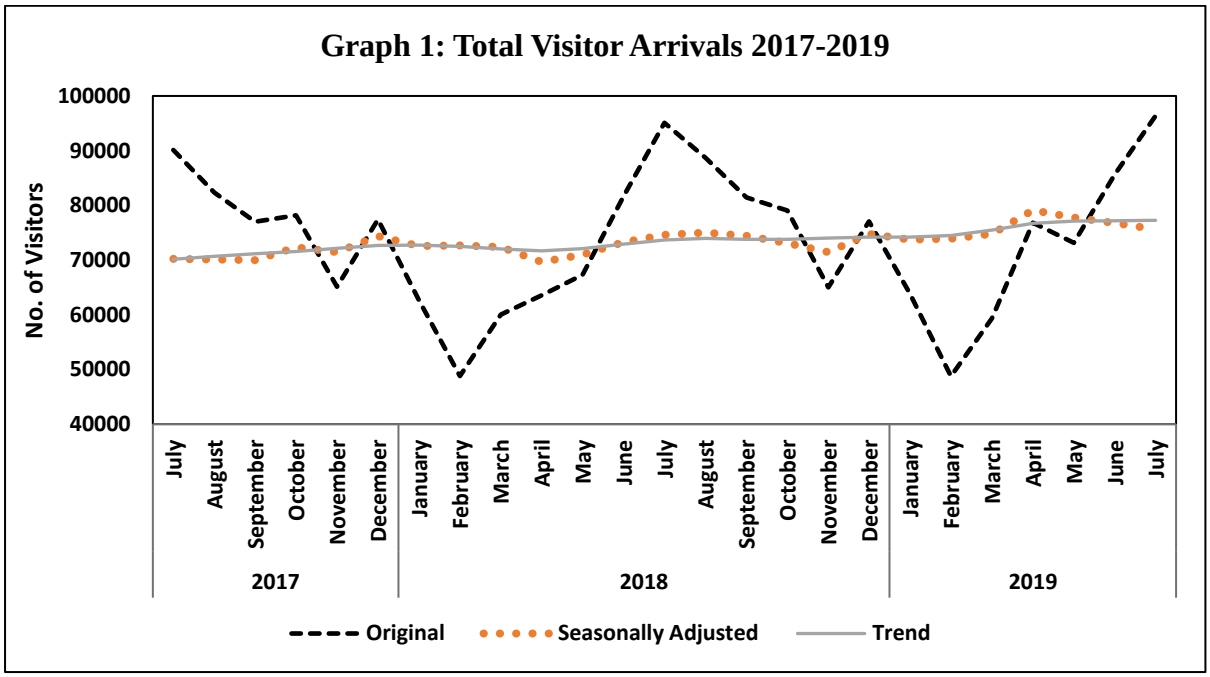
1. **Original series estimates are low because it is dominated by seasonal and irregular influences. Due to these influences, *Month-to-month % change* and *year-to-year % change* in the original estimates are not shown here and must be used with caution.**
2. ***Year-to-year % change* in the seasonally adjusted estimates are not shown here and must be used with caution as irregular influences can dominate movements.**

- **Trend estimates**: Trend estimates show the long term, underlying movement in the series after the removal of seasonal and irregular influences. The trend estimates of Total Visitor Arrivals during July 2019 (77,263) **increased by 0.13%**, compared with June 2019 (77,161). The current trend estimate for arrivals **is 4.90% higher** than July 2018.

- **Seasonally adjusted estimates**: Seasonally Adjusted estimates show the trend and irregular components after removing all seasonal and systematic related behaviors from the series. During July 2019, seasonally adjusted Total Visitor Arrivals to Fiji (75,574) **decreased by 1.59%** compared with June 2019 (76,793).

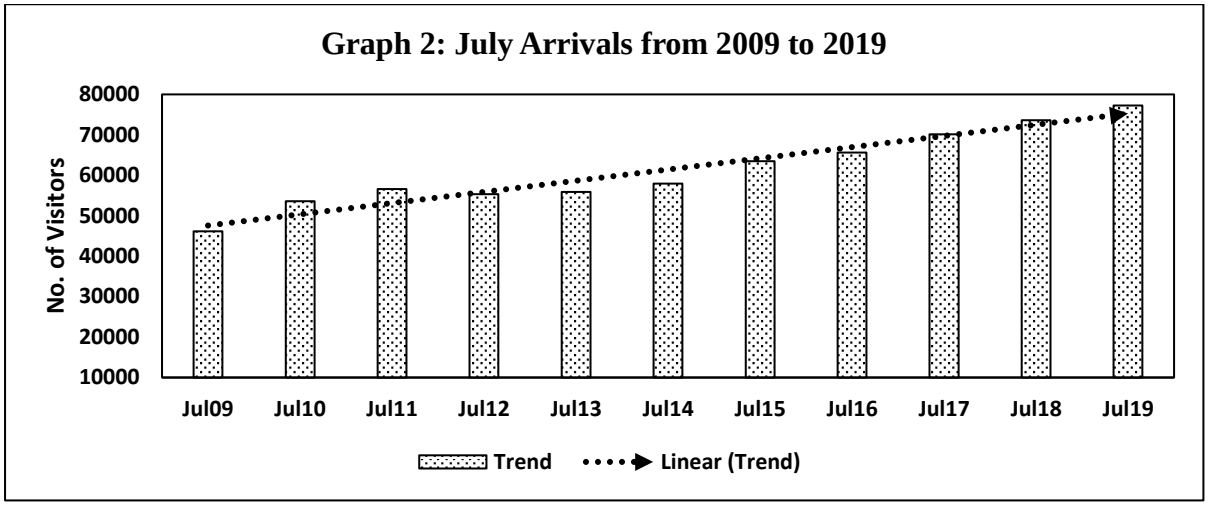
- **Original estimates**: The Total Visitor Arrivals to Fiji in July 2019 was 96,376. In this publication, the *month-to-month % change* and *year-to-year % change* is not reported as they contain seasonal and irregular influences that may hide the underlying, long term movement of the series.

Total Visitor Arrivals: Original, Seasonally Adjusted and Trend Series



Graph 1 shows the Total Visitor Arrivals to Fiji from July 2017 to July 2019 using three series: original, seasonally adjusted and trend. In terms of the original series, arrivals in February are low which could be due to visitors returning to their home countries after the holiday period in December and January. February also has less days compared to other months of the year. Arrivals in June and July on the other hand, are higher as these are winter months in the southern hemisphere. These variations contribute to calendar related, seasonal and irregular influences in the series, therefore seasonally adjusted and trend estimates are produced to show the true underlying movement of the series.

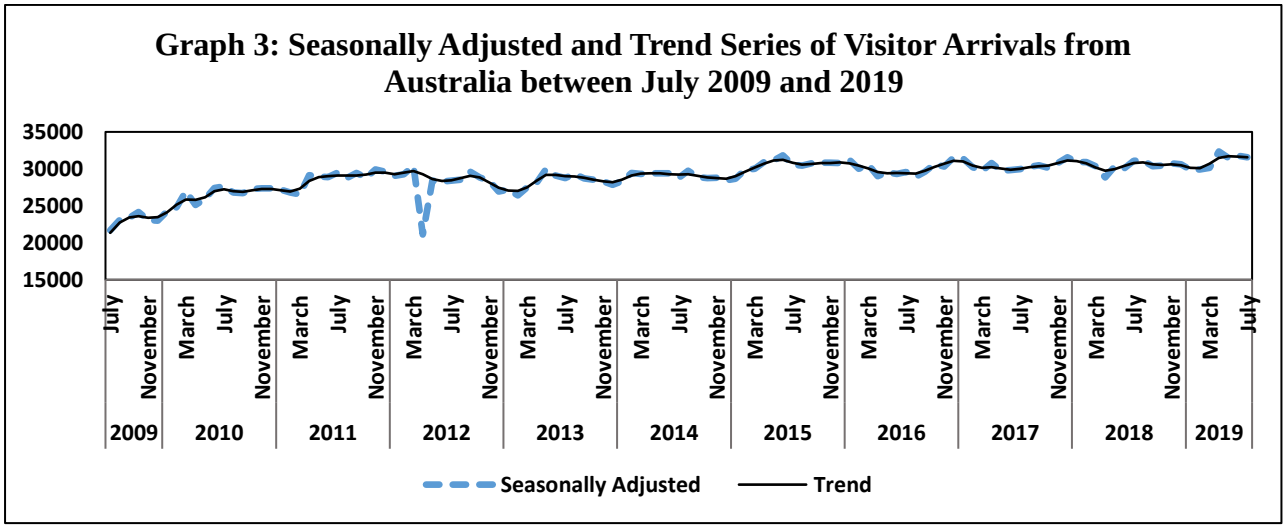
July Visitor Arrivals



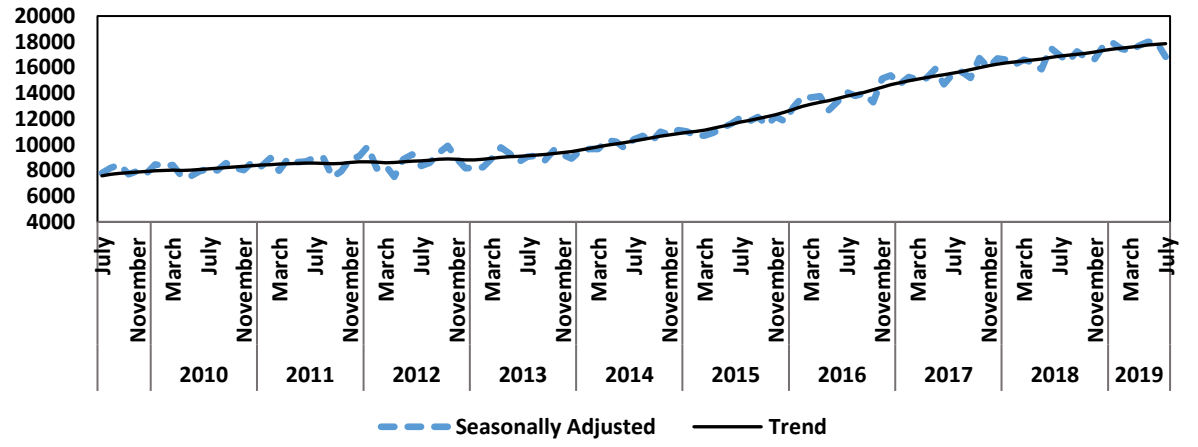
Graph 2 shows the trend of visitor arrivals to Fiji in July from 2009 to 2019. It is evident that the number of arrivals in July over the years have increased. Upon comparison between July 2018 and July 2019, a 4.90% increment was noted. To graph the long term movement of arrivals, trend series is used because it is adjusted and does not contain seasonal and irregular influences. **(For more details on trend, linear trend, seasonal and irregular influences, see "Appendix: 1, Explanatory Notes" pages: 9-11).**

Arrivals from Australia and New Zealand

Australia and New Zealand are the two major contributors of Visitor Arrivals in Fiji, consisting of 38.18% and 29.01% of total arrivals respectively. After removing seasonal and irregular influences, arrivals from Australia (Graph 3) shows a slightly increasing **trend** which has been generally stable since 2010. On the other hand, arrivals from New Zealand (Graph 4) is **trending** upwards. The seasonally adjusted series contains both the trend as well as random fluctuations and the impact of one-off real world events. Graph 3 shows the presence of a one-off event depicted by seasonally adjusted estimates in 2012. The flood period towards the end of March caused a huge reduction in arrivals from Australia in April. **(For more explanation on difference between seasonally adjusted and trend series see "Appendix: 1, Explanatory Notes").**

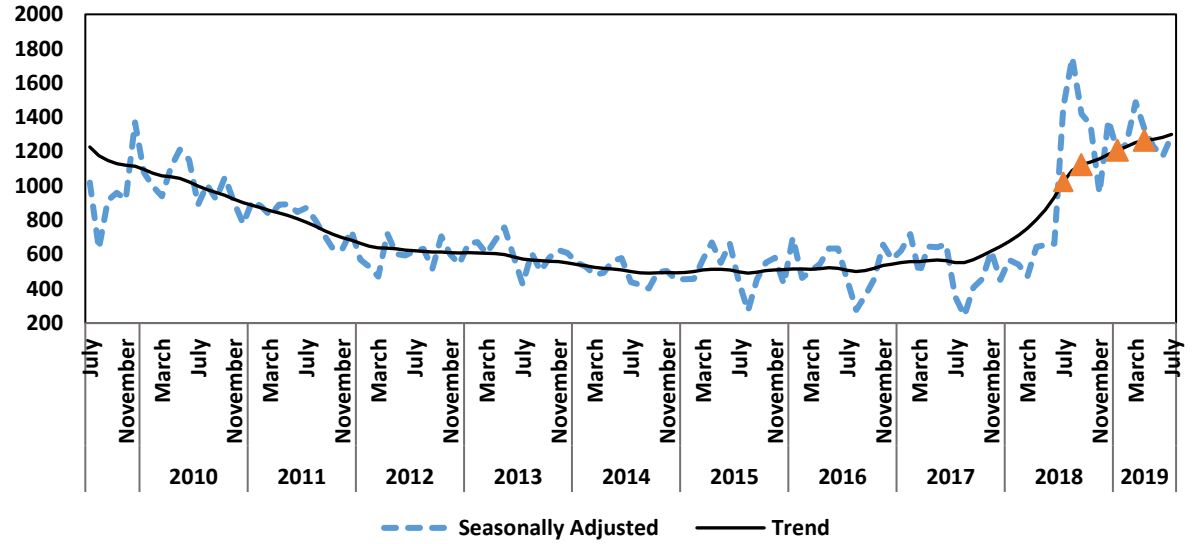


Graph 4: Seasonally Adjusted and Trend Series of Visitor Arrivals from New Zealand between July 2009 and 2019



Arrivals from Japan

Graph 5: Visitor Arrivals from Japan Between July 2009 and 2019



Graph 5 shows the number of visitor arrivals from Japan between July 2009 to 2019. In terms of the trend series, there is an increment of 27.20% compared to the same time last year. A 1.40% increment in tourist arrival was noted from June to July 2019. According to the seasonally adjusted figures, arrivals from Japan increased by 10.43% from June to July, 2019. Both, the trend and seasonally adjusted estimates show a rise in arrivals from Japan after the operational of direct flights from Narita to Fiji in July, 2018. **(For difference between seasonally adjusted and trend series see "Appendix: 1, Explanatory Notes").**

For more information, the following can be referred to:

- Table 1: Original and Seasonally Adjusted Visitor Arrivals- Number by Country of Residence
- Table 2: Seasonally Adjusted and Trend Series of Visitor Arrivals- Number by Country of Residence
- Appendix 1: Explanatory Notes

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Deputy Government Statistician

TABLE 1 **ORIGINAL AND SEASONALLY ADJUSTED VISITOR ARRIVALS : NUMBER BY COUNTRY OF RESIDENCE**

YEAR	MONTH	AUSTRALIA	NEW ZEALAND	USA	CANADA	UNITED KINGDOM	CONTINENTAL EUROPE	JAPAN	SOUTH KOREA	REST OF ASIA	PACIFIC ISLANDS	OTHERS	TOTAL
						ORIGINAL VISITOR ARRIVALS							
2017	July	34,584	26,448	9,525	1,319	1,961	3,006	564	703	7,102	4,547	349	**90,108**
	August	32,908	23,106	7,165	1,290	1,296	3,421	836	672	6,928	4,330	364	**82,316**
	September	36,323	19,099	5,795	792	1,183	2,295	655	803	5,405	4,312	367	**77,029**
	October	34,359	18,564	6,756	1,053	1,296	3,455	410	968	6,448	4,344	511	**78,164**
	November	29,686	12,214	6,465	993	1,243	3,036	394	771	5,142	4,847	360	**65,151**
	December	36,786	14,573	7,262	988	1,616	3,141	409	833	5,972	5,253	597	**77,430**
2018	January	28,313	10,612	5,617	1,000	1,321	2,952	505	792	5,569	5,529	438	**62,648**
	February	17,014	6,641	5,951	993	1,252	2,682	510	553	8,245	4,416	541	**48,798**
	March	25,196	9,868	7,264	1,196	1,474	2,706	427	720	6,667	4,112	428	**60,058**
	April	26,809	13,731	6,170	908	1,261	2,763	438	760	6,346	3,926	423	**63,535**
	May	29,730	14,383	7,059	834	1,239	3,013	391	598	5,907	3,725	411	**67,290**
	June	32,785	22,404	9,962	1,099	1,239	2,431	336	683	5,923	4,450	341	**81,653**
	July	35,608	28,572	9,104	1,675	1,871	3,392	1,736	712	7,513	4,403	475	**95,061**
	August	34,641	24,065	7,727	1,437	1,486	4,301	2,454	685	7,297	4,219	381	**88,693**
	September	35,585	21,675	6,060	883	1,000	3,176	1,723	585	6,340	4,014	396	**81,437**
	October	34,899	18,562	7,004	957	1,379	3,621	1,335	772	6,241	3,923	384	**79,077**
	November	29,828	12,631	6,913	1,063	1,145	3,092	693	699	4,314	4,290	321	**64,989**
	December	35,252	15,574	7,244	1,175	1,630	3,304	1,355	617	5,837	4,647	435	**77,070**
2019	January	27,860	11,573	5,709	1,121	1,265	2,906	1,127	766	5,806	5,203	471	**63,807**
	February	15,489	7,145	5,855	1,023	1,375	2,355	1,203	677	8,205	5,011	410	**48,748**
	March	22,972	9,457	8,323	1,247	1,471	2,758	1,468	586	6,302	4,240	482	**59,306**
	April	32,850	16,126	7,938	1,090	1,444	3,223	1,125	648	7,291	4,646	432	**76,813**
	May	30,035	16,372	8,585	984	1,374	2,536	944	813	6,876	4,179	471	**73,169**
	June	34,620	23,076	10,504	949	1,605	2,708	803	547	5,945	4,471	424	**85,652**
	July	36,799	27,963	9,926	1,601	2,020	3,541	1,571	602	6,995	4,849	509	**96,376**
						SEASONALLY ADJUSTED VISITOR ARRIVALS							
2017	July	29,958	15,512	7,145	968	1,552	2,923	354	723	6,381	4,333	361	**70,210**
	August	30,249	15,668	6,879	1,117	1,264	2,812	243	752	6,341	4,365	397	**70,087**
	September	30,481	15,192	7,224	1,125	1,539	2,715	407	844	5,347	4,716	386	**69,976**
	October	30,153	16,735	6,946	1,136	1,370	3,169	458	860	6,311	4,678	477	**72,293**
	November	30,776	15,986	6,939	1,019	1,367	3,035	619	719	5,847	4,713	399	**71,419**
	December	31,557	16,720	7,270	975	1,464	3,109	451	789	6,628	4,922	497	**74,382**
2018	January	30,921	16,618	7,103	1,103	1,408	2,946	567	739	5,864	4,848	413	**72,530**
	February	30,911	16,247	7,344	1,113	1,298	3,092	541	637	6,924	4,070	487	**72,664**
	March	30,375	16,613	7,299	1,104	1,338	2,725	472	722	6,759	4,558	422	**72,387**
	April	28,846	16,393	6,852	1,009	1,272	2,803	644	786	6,378	4,243	423	**69,649**
	May	30,339	15,850	7,118	988	1,358	3,326	655	612	6,367	3,960	428	**71,001**
	June	30,062	17,523	7,349	1,303	1,274	2,915	662	726	6,474	4,565	403	**73,256**
	July	31,110	16,988	6,994	1,231	1,454	3,257	1,458	730	6,753	4,204	451	**74,630**
	August	31,143	16,475	7,429	1,226	1,441	3,492	1,748	738	6,666	4,259	409	**75,026**
	September	30,334	17,250	7,507	1,220	1,302	3,699	1,419	625	6,284	4,388	417	**74,445**
	October	30,459	16,760	7,266	1,061	1,448	3,297	1,357	696	6,118	4,230	397	**73,089**
	November	30,742	16,657	7,454	1,103	1,276	3,092	957	663	4,962	4,180	381	**71,467**
	December	30,627	17,713	7,321	1,165	1,464	3,255	1,383	606	6,474	4,355	415	**74,778**
2019	January	29,883	17,937	7,332	1,226	1,356	2,922	1,201	715	6,130	4,556	449	**73,707**
	February	29,915	17,460	7,330	1,149	1,431	2,747	1,243	745	6,867	4,616	412	**73,915**
	March	30,152	17,297	8,204	1,137	1,351	2,990	1,488	604	6,389	4,692	459	**74,763**
	April	32,353	17,696	8,568	1,226	1,463	3,070	1,329	665	7,293	5,003	438	**79,104**
	May	31,484	17,995	8,463	1,172	1,503	2,822	1,229	797	7,374	4,452	461	**77,752**
	June	31,771	17,946	7,790	1,109	1,635	3,242	1,170	590	6,504	4,586	450	**76,793**
	July	31,550	16,840	7,738	1,189	1,559	3,373	1,292	624	6,303	4,632	474	**75,574**

*China India and Hong Kong are included in Rest of Asia due to less than 10 years of data

* Seasonally Adjusted figures and trend estimates change as new data becomes available. This ensures that the most up-to-date and best possible estimates are derived.

TABLE 2 **SEASONALLY ADJUSTED AND TREND VISITOR ARRIVALS : NUMBER BY COUNTRY OF RESIDENCE**

YEAR	MONTH	AUSTRALIA	NEW ZEALAND	USA	CANADA	UNITED KINGDOM	CONTINENTAL EUROPE	JAPAN	SOUTH KOREA	REST OF ASIA	PACIFIC ISLANDS	OTHERS	TOTAL
						SEASONALLY ADJUSTED VISITOR ARRIVALS							
2017	July	29,958	15,512	7,145	968	1,552	2,923	354	723	6,381	4,333	361	**70,210**
	August	30,249	15,668	6,879	1,117	1,264	2,812	243	752	6,341	4,365	397	**70,087**
	September	30,481	15,192	7,224	1,125	1,539	2,715	407	844	5,347	4,716	386	**69,976**
	October	30,153	16,735	6,946	1,136	1,370	3,169	458	860	6,311	4,678	477	**72,293**
	November	30,776	15,986	6,939	1,019	1,367	3,035	619	719	5,847	4,713	399	**71,419**
	December	31,557	16,720	7,270	975	1,464	3,109	451	789	6,628	4,922	497	**74,382**
2018	January	30,921	16,618	7,103	1,103	1,408	2,946	567	739	5,864	4,848	413	**72,530**
	February	30,911	16,247	7,344	1,113	1,298	3,092	541	637	6,924	4,070	487	**72,664**
	March	30,375	16,613	7,299	1,104	1,338	2,725	472	722	6,759	4,558	422	**72,387**
	April	28,846	16,393	6,852	1,009	1,272	2,803	644	786	6,378	4,243	423	**69,649**
	May	30,339	15,850	7,118	988	1,358	3,326	655	612	6,367	3,960	428	**71,001**
	June	30,062	17,523	7,349	1,303	1,274	2,915	662	726	6,474	4,565	403	**73,256**
	July	31,110	16,988	6,994	1,231	1,454	3,257	1,458	730	6,753	4,204	451	**74,630**
	August	31,143	16,475	7,429	1,226	1,441	3,492	1,748	738	6,666	4,259	409	**75,026**
	September	30,334	17,250	7,507	1,220	1,302	3,699	1,419	625	6,284	4,388	417	**74,445**
	October	30,459	16,760	7,266	1,061	1,448	3,297	1,357	696	6,118	4,230	397	**73,089**
	November	30,742	16,657	7,454	1,103	1,276	3,092	957	663	4,962	4,180	381	**71,467**
	December	30,627	17,713	7,321	1,165	1,464	3,255	1,383	606	6,474	4,355	415	**74,778**
2,019	January	29,883	17,937	7,332	1,226	1,356	2,922	1,201	715	6,130	4,556	449	**73,707**
	February	29,915	17,460	7,330	1,149	1,431	2,747	1,243	745	6,867	4,616	412	**73,915**
	March	30,152	17,297	8,204	1,137	1,351	2,990	1,488	604	6,389	4,692	459	**74,763**
	April	32,353	17,696	8,568	1,226	1,463	3,070	1,329	665	7,293	5,003	438	**79,104**
	May	31,484	17,995	8,463	1,172	1,503	2,822	1,229	797	7,374	4,452	461	**77,752**
	June	31,771	17,946	7,790	1,109	1,635	3,242	1,170	590	6,504	4,586	450	**76,793**
	July	31,550	16,840	7,738	1,189	1,559	3,373	1,292	624	6,303	4,632	474	**75,574**
						TREND SERIES VISITOR ARRIVALS							
2017	July	30,024	15,564	6,855	1,063	1,435	2,908	553	749	6,184	4,423	383	**70,141**
	August	30,229	15,697	6,933	1,082	1,421	2,920	553	775	6,191	4,478	394	**70,673**
	September	30,343	15,839	6,992	1,102	1,417	2,940	569	797	6,199	4,535	406	**71,139**
	October	30,434	15,994	7,027	1,089	1,410	2,969	594	799	6,228	4,578	417	**71,539**
	November	30,800	16,130	7,065	1,056	1,402	2,992	620	779	6,267	4,600	426	**72,137**
	December	31,122	16,250	7,116	1,047	1,397	3,005	645	754	6,305	4,593	433	**72,667**
2018	January	31,031	16,348	7,152	1,070	1,379	3,013	676	730	6,343	4,544	436	**72,722**
	February	30,734	16,427	7,179	1,089	1,354	3,018	711	713	6,386	4,474	437	**72,522**
	March	30,163	16,506	7,177	1,080	1,338	3,026	752	712	6,415	4,418	435	**72,022**
	April	29,730	16,579	7,162	1,065	1,333	3,053	803	710	6,426	4,371	432	**71,664**
	May	29,954	16,669	7,188	1,097	1,338	3,092	861	704	6,436	4,343	429	**72,111**
	June	30,398	16,783	7,227	1,171	1,353	3,130	933	707	6,450	4,340	426	**72,918**
	July	30,804	16,872	7,263	1,211	1,375	3,170	1,022	711	6,461	4,339	424	**73,652**
	August	30,877	16,946	7,322	1,206	1,383	3,208	1,090	702	6,457	4,341	422	**73,954**
	September	30,604	17,031	7,373	1,175	1,379	3,219	1,123	686	6,443	4,351	419	**73,803**
	October	30,532	17,115	7,403	1,137	1,378	3,200	1,139	673	6,425	4,364	417	**73,783**
	November	30,616	17,215	7,442	1,133	1,381	3,170	1,157	667	6,430	4,392	419	**74,022**
	December	30,462	17,338	7,493	1,159	1,391	3,138	1,184	670	6,481	4,444	423	**74,183**
2019	January	30,145	17,441	7,567	1,175	1,402	3,105	1,207	681	6,548	4,507	429	**74,207**
	February	30,093	17,513	7,702	1,170	1,412	3,085	1,229	686	6,613	4,568	435	**74,506**
	March	30,686	17,582	7,886	1,170	1,431	3,086	1,253	680	6,678	4,617	441	**75,510**
	April	31,487	17,664	8,026	1,177	1,464	3,097	1,264	682	6,744	4,644	447	**76,696**
	May	31,709	17,743	8,057	1,169	1,507	3,116	1,271	679	6,790	4,645	452	**77,138**
	June	31,633	17,798	8,021	1,158	1,542	3,148	1,282	662	6,812	4,648	457	**77,161**
	July	31,583	17,855	8,012	1,161	1,558	3,177	1,300	651	6,843	4,662	461	**77,263**

*China India and Hong Kong are included in Rest of Asia due to less than 10 years of data

*Seasonally Adjusted figures and trend estimates change as new data becomes available. This ensures that the most up-to-date and best possible estimates are derived.

APPENDIX 1: EXPLANATORY NOTES

WHAT IS A TIME SERIES?

A time series is a collection of observations of well-defined data items obtained through repeated measurements over time. For example, measuring the value of retail sales each month over several years would comprise a time series. This is because sales revenue is well defined, and consistently measured at equally spaced intervals. Data collected irregularly or only once are not time series. In this release, monthly Visitor Arrivals to Fiji by country of residence for the past 48 years (from 1970) are analyzed as a time series. An observed time series can be decomposed into three components: the trend (long term direction), the seasonal (systematic, calendar related movements) and the irregular (unsystematic, short term fluctuations).

WHAT ARE SEASONAL EFFECTS?

A seasonal effect is a systematic and calendar related effect. Some examples include the sharp escalation in most Retail series leading up to December due to the Christmas holiday period, or the increase in tourist arrivals to Fiji during the winter months of Australia and New Zealand.

WHAT IS SEASONAL ADJUSTMENT AND WHY DO WE NEED IT?

Seasonal adjustment is the process of estimating and then removing from a time series influences that are systematic and calendar related. Observed data needs to be seasonally adjusted as seasonal effects can conceal both the true underlying movements in the series, as well as certain non-seasonal characteristics which may be of interest to analysts.

WHY CAN'T WE JUST COMPARE ORIGINAL DATA FROM THE SAME PERIOD IN EACH YEAR?

A comparison of original data from the same period in each year does not completely remove all seasonal effects. Certain holidays such as Easter and Chinese New Year fall in different periods in each year, hence they will distort observations. Also, year to year values will be biased by any changes in seasonal patterns that occur over time. For example, consider a comparison between two consecutive March months i.e. compare the level of the original series observed in March for 2000 and 2001. This comparison ignores the moving holiday effect of Easter. Easter occurs in April for most years but if Easter falls in March, the level of activity can vary greatly for that month for some series. This distorts the original estimates. A comparison of these two months will not reflect the underlying pattern of the data. The comparison also ignores trading day effects. If the two consecutive months of March have different composition of trading days, it might reflect different levels of activity in original terms even though the underlying level of activity is unchanged. In a similar way, any changes to seasonal patterns might also be ignored. The original estimates also contain the influence of the irregular component. If the magnitude of the irregular component of a series is strong compared with the magnitude of the trend component, the underlying direction of the series can be distorted.

However, the major disadvantage of comparing year to year original data, is lack of precision and time delays in the identification of turning points in a series. Turning points occur when the direction of underlying level of the series changes, for example when a consistently decreasing series begins to rise steadily. If we compare year apart data in the original series, we may miss turning points occurring during

the year. For example, if March 2001 has a higher original estimate than March 2000, by comparing these year apart values, we might conclude that the level of activity has increased during the year. However, the series might have increased up to September 2000 and then started to decrease steadily.

WHICH INDICATOR SHOULD BE USED TO COMPARE MONTH-TO-MONTH OR QUARTER-TO QUARTER PERCENTAGE CHANGES?

Original estimates- ***Do not use***
Usually dominated by seasonal effects; also residual noise and irregular influences

Seasonally adjusted estimates- ***Use with caution***
Provides useful information on the effects of short term, major events. Dominated by irregular and noise, except for series with very little volatility

Trend estimates- ***Preferred option***
The best indicator of underlying behavior for month-to-month or quarter-to-quarter changes. Recent estimates, usually the last 3 or 4, may be revised.

WHEN IS SEASONAL ADJUSTMENT INAPPROPRIATE?

When a time series is dominated by the trend or irregular components, it is nearly impossible to identify and remove what little seasonality is present. Hence seasonally adjusting a non-seasonal series is impractical and will often introduce an artificial seasonal element.

WHAT IS SEASONALITY?

The seasonal component consists of effects that are reasonably stable with respect to timing, direction and magnitude. It arises from systematic, calendar related influences such as:

- **Natural Conditions**
  Weather fluctuations that are representative of the season (uncharacteristic weather patterns such as snow in summer would be considered irregular influences).
- **Business and Administrative procedures**
  Start and end of the school term.
- **Social and Cultural behavior**
  Christmas.

It also includes calendar related systematic effects that are not stable in their annual timing or are caused by variations in the calendar from year to year, such as:

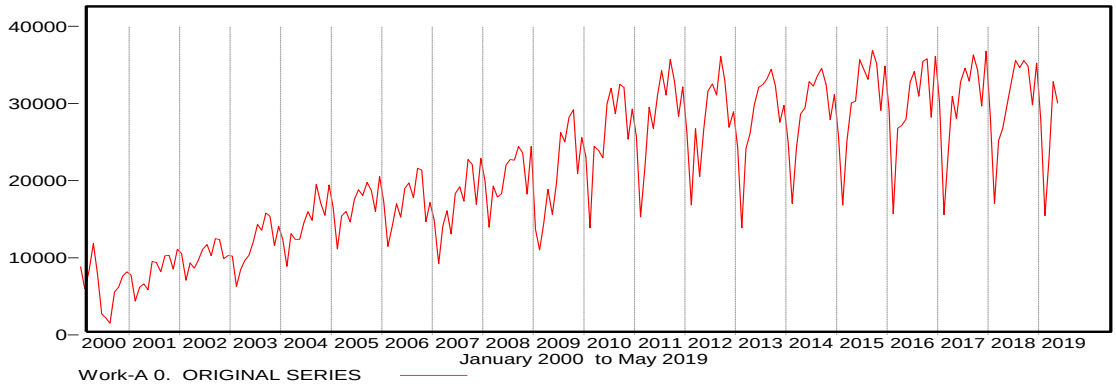
- **Trading Day Effects**
  The number of occurrences of each of the day of the week in a given month will differ from year to year
  - There were 4 weekends in March in 2000, but 5 weekends in March of 2002

- **Moving Holiday Effects**
  Holidays which occur each year, but whose exact timing shifts
  - Easter, Chinese New Year

HOW DO WE IDENTIFY SEASONALITY?

Seasonality in a time series can be identified by regularly spaced peaks and troughs which have a consistent direction and approximately the same magnitude every year, relative to the trend. The following diagram depicts a strongly seasonal series. There is an obvious large seasonal increase in December tourist arrival to Fiji from Australia in December due to holiday season in Australia and a decline in January as tourists return. In this example, the magnitude of the seasonal component increases over time, as does the trend.

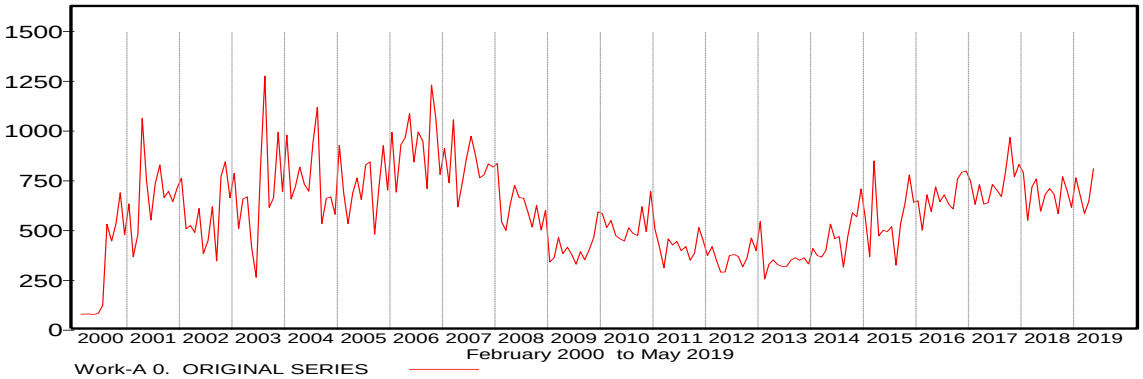
Visitor Arrivals from Australia to Fiji



WHAT IS AN IRREGULAR?

The irregular component (sometimes also known as the residual) is what remains after the seasonal and trend components of a time series have been estimated and removed. It results from short term fluctuations in the series which are neither systematic nor predictable. In a highly irregular series, these fluctuations can dominate movements, which will mask the trend and seasonality. The following graph is an example of a highly irregular time series.

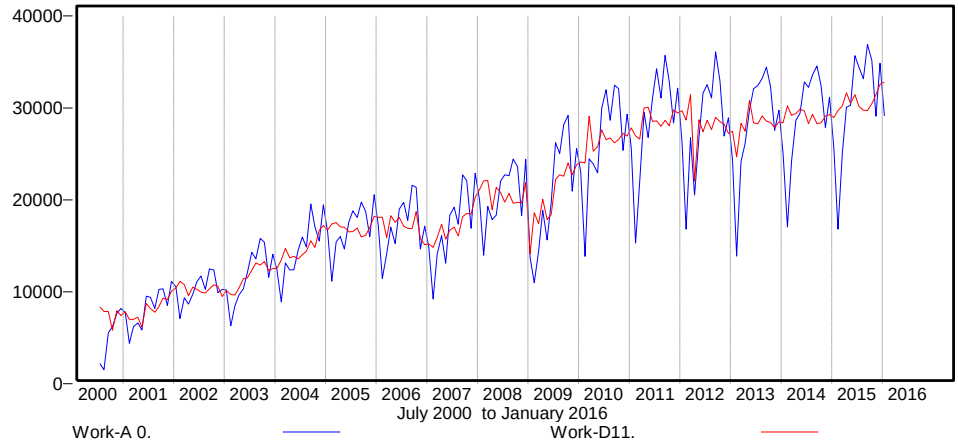
Visitor Arrivals from South Korea to Fiji



WHAT IS THE TREND?

The trend is defined as the 'long term' movement in a time series without calendar related and irregular effects, and is a reflection of the underlying level. It is the result of influences such as population growth, price inflation and general economic changes. The following graph depicts a series in which there is an obvious upward trend over time:

Visitor Arrivals from Australia to Fiji- Trend



Work A.0- Original **Work-D11- Trend**

LINEAR TREND

Linear trend is a “straight line” which gives the general direction that a group of points seems to follow. In this publication, linear trend is used only to visualize the overall direction of visitor arrivals to Fiji in terms of the trend series.

HOW IS SEASONAL ADJUSTMENT CONDUCTED?

A filter based method of seasonal adjustment based on the X13, is applied to FBoS series. The procedure consists of the following steps:

1) Estimate the trend by a moving average
2) Remove the trend leaving the seasonal and irregular components
3) Estimate the seasonal component using moving averages to smooth out the irregulars.

Seasonality generally cannot be identified until the trend is known, however a good estimate of the trend cannot be made until the series has been seasonally adjusted. Therefore, X13 uses the X-13-ARIMA-SEATS program from the US Census Bureau to estimate the components of a time series. The program is a superset of the X-12-ARIMA program and it implements the X-11 algorithm.

HANDLING UNUSUAL BEHAVIOURS IN A TIME SERIES

Often series display behaviour that is not consistent with the expected seasonal pattern or trend. When series are not well behaved they need to be corrected or adjusted to avoid obtaining an inferior seasonal adjustment. Since seasonal adjustment often involves filters, any strange values will have a large impact on the final result average is influenced by a real large or low value. The original series are not always well behaved. In reality, there are activities that are systematic and predictable, but doesn’t affect the same calendar period the same way every year, for example, moving holidays, trading day, etc. There are cases

of unusually high or low values, sudden and sustained level shifts, and sudden and sustained changes in the seasonal pattern. Before estimating the components of the time series, we need to correct for these so that we have a series that is better but may not be perfect because we are still dealing with estimates. Prior corrected series is used for calculating higher quality estimates of the Seasonal factors and the Trend. It enables more adequate models to be found both in terms of the decomposition model and ARIMA model. It also ensures that the results of the seasonal adjustment process are not distorted by known events.

EXTREME VALUES

Extremes or outliers are values in a time series that are unusually large or small relative to the other data. They can distort the appearance of the underlying movement of the time series by altering the trend. For this reason, and to improve estimation of the three series components (trend, seasonal and irregular), it is necessary to detect and correct outliers.

For example, a real world event one off event (like a tropical cyclone) could lead to a sudden and drastic decline or increase in the number of Tourist Arrivals. In this case, an extreme value correction is applied prior to seasonal adjustment to ensure an optimal result. The value is then returned to the seasonally adjusted series to show the extent of the effect of the real world event.

TREND BREAKS

An abrupt but sustained change in the level of a time series is known as a trend break. This is reflected in at least 6 months or 3 quarters of raised or lowered levels. If the span of increased or decreased values is shorter than this, they are classified as extreme values.

For example, real world events could lead to a sudden and sustained change in the level of the series. In this case, trend break corrections are applied and the factor is returned to the trend and seasonally adjusted series.

(Source: Australian Bureau of Statistics)