

Article

Predicting the Impact of COVID-19 on Australian Universities

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Abstract: This article explores the impact of the novel coronavirus (COVID-19) upon Australia's education industry with a particular focus on universities. With the high dependence that the revenue structures of Australian universities have on international student tuition fees, they are particularly prone to the economic challenges presented by COVID-19. As such, this study considers the impact to total Australian university revenue and employment caused by the significant decline in the number of international students continuing their studies in Australia during the current pandemic. We use a linear regression model calculated from data published by the Australian Government's Department of Education, Skills, and Employment (DESE) to predict the impact of COVID-19 on total Australian university revenue, the number of international student enrolments in Australian universities, and the number of full-time equivalent (FTE) positions at Australian universities. Our results have implications for both policy makers and university decision makers, who should consider the need for revenue diversification in order to reduce the risk exposure of Australian universities.

Keywords: COVID-19; education; Australian universities; revenue; international student enrolment; full-time equivalent employment

1. Introduction

The tertiary sector of Australia's education industry has been forced to rapidly respond to the outbreak of the novel coronavirus (COVID-19), which in turn has exposed it to new financial risks and its over-dependence on international markets. Australian universities in particular are now dealing with the prospect of losing up to \$19 billion in revenue by 2023 as a result of their reliance on tuition fees from international students, many of whom are currently unable to travel to Australia (Hurley and Dyke 2020). This is reflected in the way that the number of international student enrolments has decreased from 4,608,520 in 2019 to just 708,671 in May, 2020 (DESE 2020b). As such, the immediate impact of COVID-19 is already being felt by Australian universities and has the potential to cause long-term losses depending on how long current international travel restrictions remain in place. Furthermore, Australian universities act as a major source of the nation's future productive human capital and therefore this sector takes on added significance given the extensive economic recovery required post COVID-19. In 2019, international education was Australia's fourth largest export, contributing \$40.4 billion to the economy (Ross 2020a). As such, universities are key to

both Australia's current and future economic fortunes and in this way warrants the need for extensive investigation into the potential impacts of COVID-19.

Existing research documents the challenges faced by Australia's university sector in relation to governance issues and the dependence on international students (Howes 2018; Goodwin 2018). Furthermore, recent literature has heavily detailed the initial outbreak and government responses to COVID-19 with a particular focus on the differing national responses and strategies to curbing the virus (Del Rio and Malani 2020; Duckett and Stobart 2020). There has, however, only been limited research and modelling (e.g., Hurley and Dyke 2020) released that details the impact of COVID-19 upon total Australian university revenue and international student enrolments. Furthermore, current estimates of the impact to university employment have been limited in scope as highlighted by the statement issued by Catriona Jackson, Universities Australia CEO, "Universities estimate that more than 21,000 jobs are at risk in the next six months, and more after that" (Universities Australia 2020c). Therefore, a research gap exists to investigate the impact of COVID-19 on total Australian university revenue, employment, and international student enrolments.

This study aims to assess the changes caused by COVID-19 to total Australian university revenue, international student enrolments in Australian universities, and the number of full-time equivalent (FTE) positions provided by Australian universities. Previous data released between 2008 and 2018 makes it possible to generate a correlation matrix between these variables and allows for the presence of seasonal changes to be identified and considered. This data was used as it was the most recently released by the Australian Government's Department of Education, Skills, and Employment (DESE) prior to the impact of COVID-19 for the variables of total Australian university revenue and the total number of FTE jobs at Australian universities. By using a linear regression model, we were then able to use the actual number of current international student enrolments in Australian universities for 2020 to estimate the predicted effect that COVID-19 will have on total Australian university revenue and FTE jobs at Australian universities. This investigation consequently provides scholars, policy makers, and university decision makers with strategic foresight into the potential changes in Australia's university sector caused by COVID-19.

As the major focus of this study is to assess the impact of COVID-19, it is first necessary to briefly review the state of coronavirus in Australia. Secondly, an overview of the strategic importance of Australia's education industry gives context to reviewing the current governance and business models of Australian universities. This then provides the basis for identifying 'pressure points' of Australian universities that are most likely to be impacted by COVID-19.

2. Literature Review and Hypotheses

COVID-19 is a respiratory infection caused by the virus SARS-CoV-2, and was discovered following an outbreak in Wuhan, China, in December 2019 (Desai and Patel 2020). Australia's first case of COVID-19 was recorded on 22nd January, 2020 and at the time of writing (June 2020) there has been 7391 confirmed cases and 102 related deaths (Australian Government Department of Health 2020a). Modelling released by the Australian Government Department of Health (2020b) highlights that the government enforced shutdowns of economic activity and the implementation of strict social distancing measures have to this point been effective in suppressing community transmission of COVID-19. Consequently, there currently exists a trade-off between health-related risks, which have largely been prioritised, and economic risk which has greatly increased (Hedegaard and Hodrick 2016; Chang and McAleer 2020; White 2020). This creates higher risk exposure for all Australian industries, including education and more specifically the university sector, with economic growth contracting as a result of government enforced lockdowns (Wen et al. 2020; OECD 2020). The continued shutdown of economic activity could result in Australia's economic growth declining by 22% in the short-term with GDP decreasing at a rate of 2% per month for each month that strict containment measures remain enforced (Kehoe 2020; OECD 2020). Attention should therefore be paid to industries such as education that hold the potential to accelerate Australia's economic recovery from COVID-19. In particular, universities

have an important part to play, given their role as enablers of Australia's current and future productive human capital.

Previous research has clearly demonstrated the link between Australian universities and higher economic growth (Deloitte Access Economics 2015). Growth of international student enrolments has also facilitated the growth of education to become Australia's fourth largest export in 2019 (Ross 2020a). Benefits flow not only at a national level but are also apparent at the household level, with higher educational attainment being associated with numerous individual advantages including higher lifetime earnings (Chapman and Lounkaew 2015). More recently, studies have identified the clear role that universities must play to accelerate the process of economic recovery from COVID-19 (Majowicz 2020; Group of Eight Australia 2020). In particular, the continued investment in Australian universities plays a key role in generating greater taxation revenue and overall economic activity in the future (Deloitte Access Economics 2015). The challenges posed by COVID-19 to Australia's universities therefore have far broader economic implications than just those directly related to the financial health of the education industry.

Universities, both in Australia and around the world, have been forced to rapidly change the content and delivery of their offerings to accommodate social distancing requirements and economic shutdowns caused by COVID-19 (Watermeyer et al. 2020; Fernandez and Shaw 2020; Francisco et al. 2020). The switch to online study and other remote learning programs has been acknowledged as placing extensive strain on both university staff and existing technological infrastructure (Houlden and Veletsianos 2020). Despite such strains, this rapid transition to online study has benefitted both domestic and international students by enabling them to continue their degree progression in addition to providing continued employment for current university staff, albeit at a reduced capacity (Bolton 2020b). Issues with international students have also arisen with international travel bans imposed to slow the spread of COVID-19. In the case of Australian universities, travel restrictions have impeded the ability of more than 100,000 international students from China to begin the 2020 academic year (Daley and Mackey 2020). Indeed, Jayasuriya (2020) identifies that the economic slowdown created by COVID-19 has exposed the reliance that Australian universities have had on the tuition fees of international students and that this creates significant challenges for their future revenue base given the current ban on overseas travel. We suggest that such reliance on international students creates a pressure point for Australian universities that is directly exposed to COVID-19 and increases risk.

With clear exposure to international markets, university governance in Australia takes on an added role of significance in managing external shocks. Structural changes that resulted in the creation of modern day enterprise universities can be traced back to the deregulation and funding cuts to Australian universities in the 1980s (Pietsch 2019; Howes 2018). Jayasuriya (2020) notes that the privatisation of domestic student tuition fees through the Higher Education Contribution Scheme (HECS) and the extensive reliance on international student enrolments makes the current climate for Australian universities very precarious. In 2020, 58% of international students in Australia come from five countries, with China being the single largest contributor at 27% (DESE 2020b). Goodwin (2018) consequently concluded in his audit of New South Wales universities that the dependence on international students, particularly from China, was concerning given that total course fee revenue from international students was 54.5% greater than that of domestic students. The declining nature of federal funding to Australian universities accentuates the dependence on overseas students with the Commonwealth Grant Scheme (CGS), the main source of government funding for universities, being capped at 2017 levels (Universities Australia 2020a). Universities have therefore been more pragmatic and acted like corporate entities by prioritising international markets as their key source of growth (Loomes et al. 2019). With COVID-19 compromising the ability of international students to resume their studies in Australia, there are serious implications for the financial resilience of Australian universities.

The gearing of Australia's universities and their selective use of debt finance has attracted new levels of attention in the wake of COVID-19 (Bolton 2020a). The inability of international students to travel to Australia to physically attend university has to this point seen a significant increase in the

number of these students choosing to defer their studies. Year-to-date deferments for international students at Australian universities in April, 2020 increased by 40,725 from the same period in 2019 (DESE 2020c). As such, Australian universities face the need to reconsider their main sources of capital in the short-to-medium-term as the economic effects of COVID-19 set in. With Australian universities receiving the majority of their funding through the CGS, there are calls to offset falling enrolments by taking on new debt considering that an increase in government funding is unlikely due to the large economic stimulus packages recently introduced by the Morrison government (Universities Australia 2020b; Marshman and Larkins 2020; Kenny 2020). Moreover, Ross (2020b) highlights that Australian universities may be better off seeking assistance from state governments as seen with the NSW state government which has pledged to guarantee up to \$750 million in commercial loans to help universities in NSW recover from COVID-19. Borrowing funds consequently provides the scope for Australian universities to minimise the immediate impact of declining revenue in addition to offering the capital needed to increase their capacity to offer more courses online whilst face-to-face teaching remains impractical. It should be considered, however, that the cost of debt for universities has increased relative to banks and governments (Ross 2020b). As a result, Australian universities are moving to streamline their cost structures, namely employee costs which account for 57% of university spending, before looking to take on additional debt (Marshman and Larkins 2020). Employment at Australian universities is therefore precariously positioned and likely to be one of the areas that is most severely affected by COVID-19.

This study looks to assess the multi-faceted impact that COVID-19 will have on Australia's universities. Given that the majority of Australia's international student population comes from five countries any external shock, let alone one the size of COVID-19, will detrimentally impact Australian universities (DESE 2020b). As such, the steady growth in international student enrolments at Australian universities over the last decade is likely to be heavily disrupted. Moreover, the way in which international student enrolments have been the key driver of revenue growth for Australian universities suggests that the impact of COVID-19 on this sector will be severe. In the most recently reported period in 2018, total Australian university revenue grew by 5.4% year on year (DESE 2018a). The dependence on international student enrolments for this growth consequently increases the exposure of total Australian university revenue to the effects of COVID-19. Our research therefore seeks to clarify the relationship between these variables and we subsequently propose the following hypotheses:

Hypothesis 1a (H1a). *COVID-19 negatively affects the number of international student enrolments at Australian universities.*

Hypothesis 1b (H1b). *A decrease in international student enrolments at Australian universities below their ten-year average will cause a decrease in total Australian university revenue.*

Hypothesis 1c (H1c). *COVID-19 negatively affects total Australian university revenue.*

The impact on employment is a consequence of changes to overall revenue and student enrolments in Australian universities. Changes in work arrangements as a result of COVID-19 have been well documented, with employees largely working from home with more flexible working hours (Spurk and Straub 2020; Hodgson et al. 2020). In Australia, the federal government introduced a wage subsidy in March, 2020 known as the JobKeeper program, enabling businesses who passed a 'decline in turnover test' to pass on fortnightly payments from the Australian Taxation Office to eligible employees (Australian Government Federal Register of Legislation 2020). The wide scale use of short-term or fixed contracts at Australian universities has prompted concern for academics and other university staff who do not meet the JobKeeper eligibility criteria of having had worked with their current employer for at least twelve months (Harris et al. 2020). Moreover, academic research output is estimated to be heavily affected by a decline in both public and private funding as a result of COVID-19 (Larkins et al. 2020). Much like the situation with international student enrolments, COVID-19 has exposed the precarious

nature of Australian university employment, which has long shown signs of job insecurity (Broadbent and Strachan 2016). Whilst there is extensive literature on the topic of job security and stress levels of Australian university employees (e.g., Langford 2010), this research remains outside the scope of our study. Our focus remains on the impact of COVID-19 on Australian universities with respect to total revenue, international student enrolment, and employment.

With a decline in both the level of funding available for academic research and the ability of international students to resume their studies in Australia, employment at Australian universities is likely to be severely impacted. As such, we identify the number of FTE positions at Australian universities as another pressure point that will be significantly affected by COVID-19. Based upon this, we propose the following hypotheses:

Hypothesis 2a (H2a). *COVID-19 negatively affects the number of FTE positions at Australian universities.*

Hypothesis 2b (H2b). *A decrease in FTE employment at Australian universities will cause a decrease in total Australian university revenue.*

3. Methodology

We tested our hypotheses using data published by the DESE. The DESE (2020a) exists to facilitate quality education, skills, and employment opportunities for all Australians and has numerous strategic objectives, including creating a globally competitive tertiary education system. We sourced the data for the total revenue of Australian universities from the DESE's annual 'Finance Publication' for the years 2008 through 2018 (DESE 2008a, 2009a, 2010a, 2011a, 2012a, 2013a, 2014a, 2015a, 2016a, 2017a, 2018a). These publications compile information from the financial reports, namely the statements of financial position, performance, and cash flows, that have been published by Australian universities for the year ending 31st December for each year. At the time of writing, the 2019 Finance Publication had not been published and as such we used the most recent data available to include in our study. The data on international student enrolments was sourced from the DESE (2020b, 2020c) international student dataset, with figures used for enrolments in 2008 through to 2018 as well as for the year to May in 2020, which were the most recently updated statistics at the time of writing. In regards to the FTE employment data for Australian universities, it was retrieved from the 'Staff Data' statistics published by the DESE for the years 2008 through 2018 (DESE 2008b, 2009b, 2010b, 2011b, 2012b, 2013b, 2014b, 2015b, 2016b, 2017b, 2018b). The data includes information on the number of FTE staff employed by Australian universities as at 8th December for each year. Again, at the time of writing, these were the most recently available statistics that could be used for our study. Sourcing the data published by the DESE for all our variables has the main advantage of using data from a reputable and reliable source. Furthermore, using data that is reported and consolidated by one body ensures consistency in the measurement across variables and hence, does not impact the validity of our study.

The causal research design for this study was used in order to assess the relationship between total Australian university revenue, international student enrolment, and the number of FTE employment positions provided by Australian universities. The analysis techniques that were conducted in this study include correlation analysis and linear regression analysis to assess the relationship between the variables under investigation. The correlation matrix was used to check for the probability of multicollinearity whilst the regression model was used to estimate how COVID-19 influences total Australian university revenue and the other auxiliary variables. To improve the robustness of our study, we performed a residual analysis to assess the suitability of our data and predicted values for linear regression. This included checking that the residuals were not correlated with our predicted values, making sure that the residual variance remained constant across all of our predicted values, and that the residuals were approximately normally distributed. Additionally, we checked for outliers and any other highly influential points. Based on our investigation of the seasonal changes in international student enrolments between 2008 and 2018, we used a trend analysis to predict the number of international

student enrolments at Australian universities by quarter for 2020. Given that our 10 year data set for this variable does not include any time period affected by COVID-19, we used this prediction to show the number of international student enrolments at Australian universities for 2020 had COVID-19 not made any impact. Furthermore, we use the linear regression model to predict a range of values for our two other auxiliary variables in order to estimate the possible changes caused by COVID-19. This was achieved by running the regression model twice; once with our predicted value for 2020 international student enrolments, which shows no impact of COVID-19, and once with the year to date figures for international student enrolments published by the DESE in 2020. This therefore enabled us to predict a range of values for both total Australian university revenue and FTE employment at Australian universities for 2020. Whilst the number published by the DESE will change in coming months, the ban on international travel makes it unlikely that such changes will be significant in size and therefore does not impact the validity of our study. Additionally, the results of our study with the current figures enable us to demonstrate a best-case, worst-case scenario for Australian universities depending on the severity of the effects of COVID-19. Furthermore, our analysis would have been made more accurate by the inclusion of 2019 data, however, it was not available at the time of writing. It should be considered though that the 2019 data will not reflect any of the changes caused by COVID-19 and in this way would not have fundamentally changed the outcome of our analysis.

Dependent Variable:

We used total Australian university revenue as our dependent variable to measure the effects of COVID-19, where total Australian university revenue is the cumulative sum of each university's revenue within Australia in a given year. As such, we looked to see the changes to total Australian university revenue that have occurred over time. Of particular interest is the change from the most recently reported figure by the DESE for total Australian university revenue in 2018 and our predicted value for this variable, as it will show any change caused by COVID-19.

Independent Variables:

Our two independent variables for this study were the number of international student enrolments in Australian universities, and the number of FTE employment positions at Australian universities. We used these independent variables as we believe they will exert the biggest influence on total Australian university revenue as a result of COVID-19. The number of international student enrolments is measured by calculating the number of full fee paying university students in Australia that were born in a country other than Australia and that currently hold a student visa. FTE employment positions at Australian universities is measured as the cumulative number of equivalent full-time positions across all Australian universities in a given year. This includes staff who work full-time, fractional full-time, and as casual staff based on their work contract.

4. Results

Based on our analysis of 10 years' worth of international student enrolment data, we identified two key seasonal changes in this variable. Table 1 displays these seasonal changes by providing the average monthly enrolments by international students at Australian universities for the years 2008 through 2018. In particular, the greatest change in enrolments occurs at two times of the year; at the beginning between the months of January and March, and in the middle between the months of June and July. This is due to the fact that these are the months that immediately precede the beginning of the two core academic semesters for undergraduate students in Australia; current 2020 start dates for the autumn semester range from the end of February through to March, whilst start dates for the spring semester range from the beginning of June through to August depending on the academic institution ([Universities Australia 2020b](#)). Small decreases in international student enrolments following these two peak periods can be explained by students choosing to withdraw their enrolment from particular courses prior to census deadlines for their academic institution.

Table 1. Average International Student Enrolments at Australian Universities by Month for 2008 through 2018.

Average International Student Enrolments at Australian Universities by Month											
January	February	March	April	May	June	July	August	September	October	November	December
155,950	193,150	206,890	205,141	204,885	206,790	228,134	223,149	222,427	224,358	219,928	220,979

From the seasonal variation in international student enrolments by month, we utilised trend analysis to predict total international student enrolments at Australian universities for 2020. Due to the fact that the international student enrolment data used for this trend analysis was for the time period preceding COVID-19, the predicted values do not reflect the impact of COVID-19. The predicted values for international student enrolments at Australian universities in 2020 have been done as quarters so as to take into account the seasonal impact and can be seen below:

$$\begin{aligned}
 2020 \text{ Q1} &= 941,011.813 \\
 2020 \text{ Q2} &= 1,008,182.23 \\
 2020 \text{ Q3} &= 1,075,432.15 \\
 2020 \text{ Q4} &= 1,072,177.48
 \end{aligned}$$

Total predicted international student enrolments for 2020 at Australian universities = 4,096,803.673 = 4,096,804 (nearest whole enrolment)

The predicted 4,096,804 international student enrolments for 2020 serves as an absolute best-case scenario for Australian universities whereby international student enrolments continue to grow at pre COVID-19 levels. In reality, COVID-19 has had a significant impact on the number of international student enrolments at Australian universities with actual figures released by the DESE (2020b) for January to May only being 708,671 enrolments. When compared to the average international enrolments for 2008 through 2018 in Table 1 for the same five months, it becomes evident that COVID-19 has resulted in a large reduction for this variable. As shown by Table 1, the average number of international student enrolments for January through May for 2008–2018 was 966,016 enrolments. We argue that such a decline of 257,345 enrolments can be largely attributed to the effects of COVID-19 rather than due to the influence of another variable considering the imposition of current international travel bans designed to curb the spread of the virus. Figure 1 displays the decline of international student enrolments at Australian universities relative to the years 2008 through 2018. This finding consequently suggests that COVID-19 is the single largest contributor to the significant drop in international students currently enrolled at Australian universities, which in turn supports Hypothesis 1a.

To assess the suitability of our dataset for linear regression, we performed several checks as part of a residual analysis to make sure certain assumptions were met. Firstly, we checked for residual correlation to make sure that the residuals were not correlated with our predicted values. Figure 2 shows the residual plot for the regression model between international student enrolments at Australian universities and total Australian university revenue. Figure 3 shows the residual plot for the regression model between FTE employment positions at Australian universities and total Australian university revenue. The scattered and fairly random nature of the residuals in Figures 2 and 3 indicates that a linear model provides a decent fit for the data. From this, we produced Figures 4 and 5 to demonstrate that the residuals are not correlated with our predicted values and that the residual variance is constant across all the predicted values. Figure 4 shows the line fit plot for the regression model between international student enrolments at Australian universities and total Australian university revenue. Figure 5 shows the line fit plot for the regression model between FTE employment positions at Australian universities and total Australian university revenue. From these figures, it becomes apparent that the residuals are not correlated with our predicted values and that the residual variance is constant for all the predicted values. Secondly, we checked to see that the residuals are approximately normally distributed. We found that the kurtosis and skewness of the residuals for both regression models approached zero and as such we established that the residuals were normally distributed.

Thirdly, we checked for outliers and highly influential points. Given that the standard residuals for both regression models are larger than -2 and smaller than 2 , we concluded that there were no outliers or highly influential points.

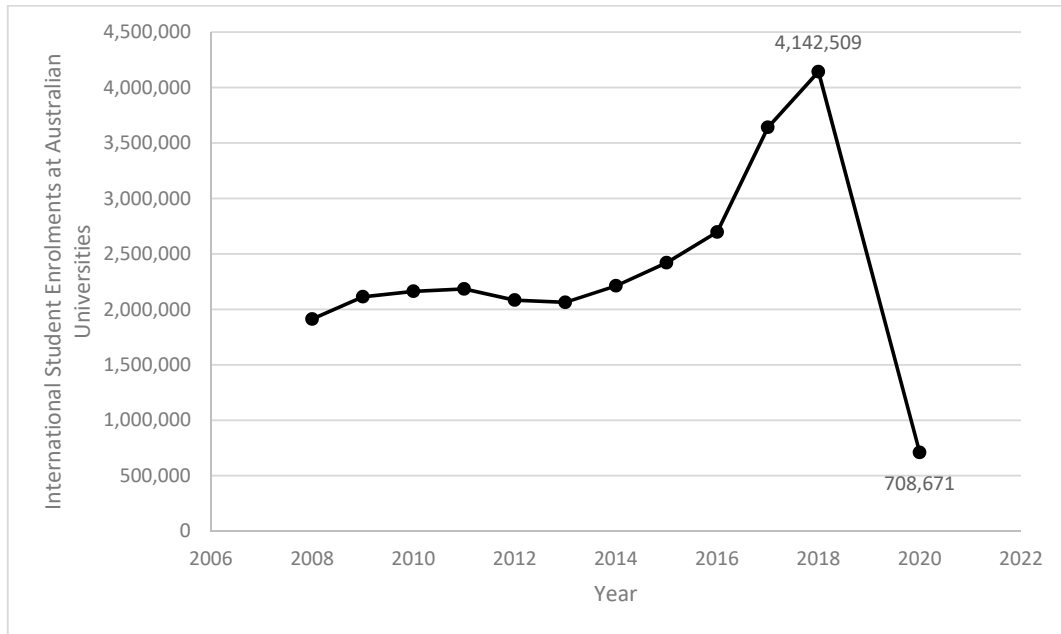


Figure 1. Impact of the novel coronavirus (COVID-19) on International Student Enrolments at Australian Universities.

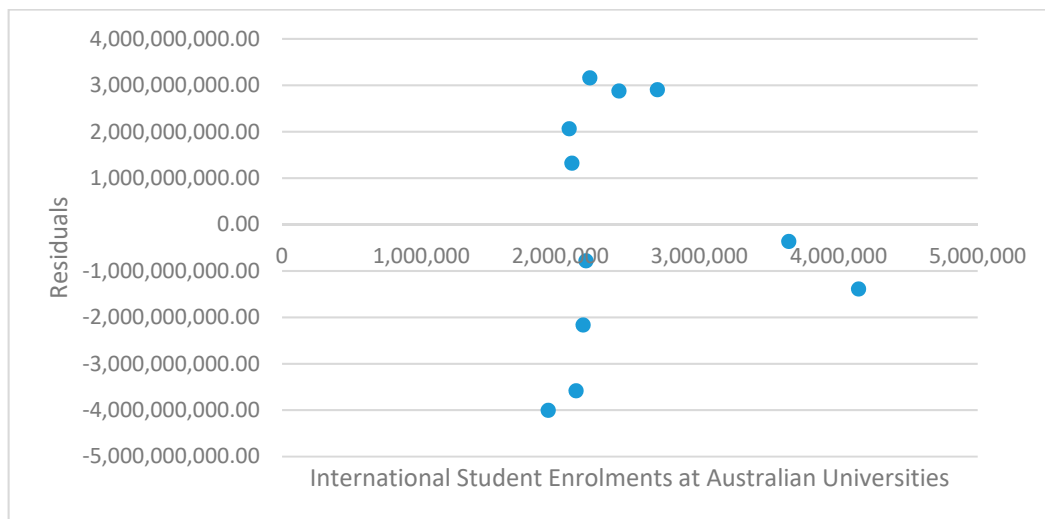


Figure 2. Residual Plot for International Student Enrolments and Total Australian University Revenue.

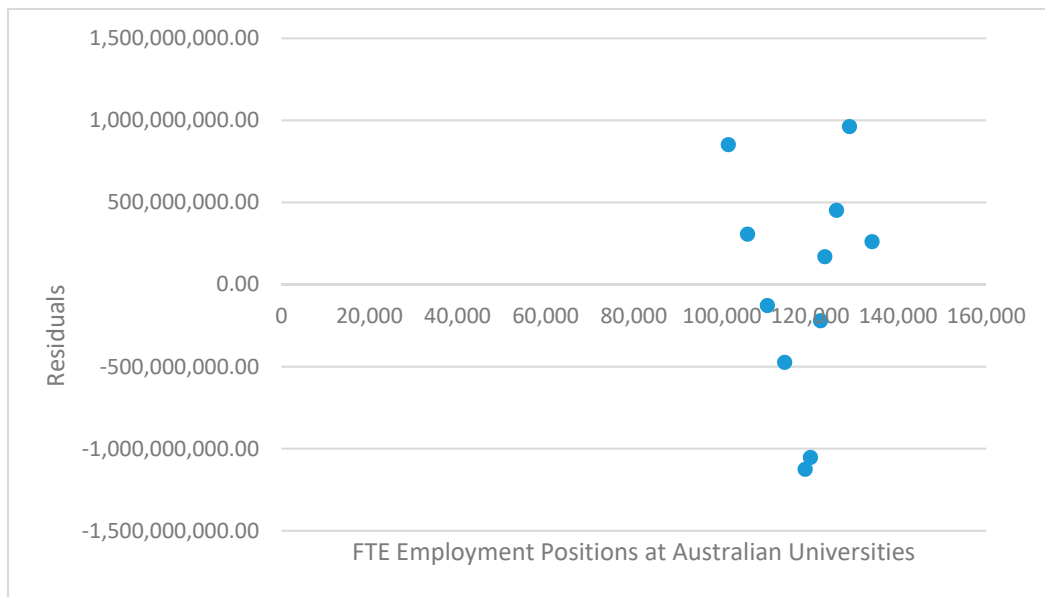


Figure 3. Residual Plot for Full-Time Equivalent (FTE) Employment and Total Australian University Revenue.

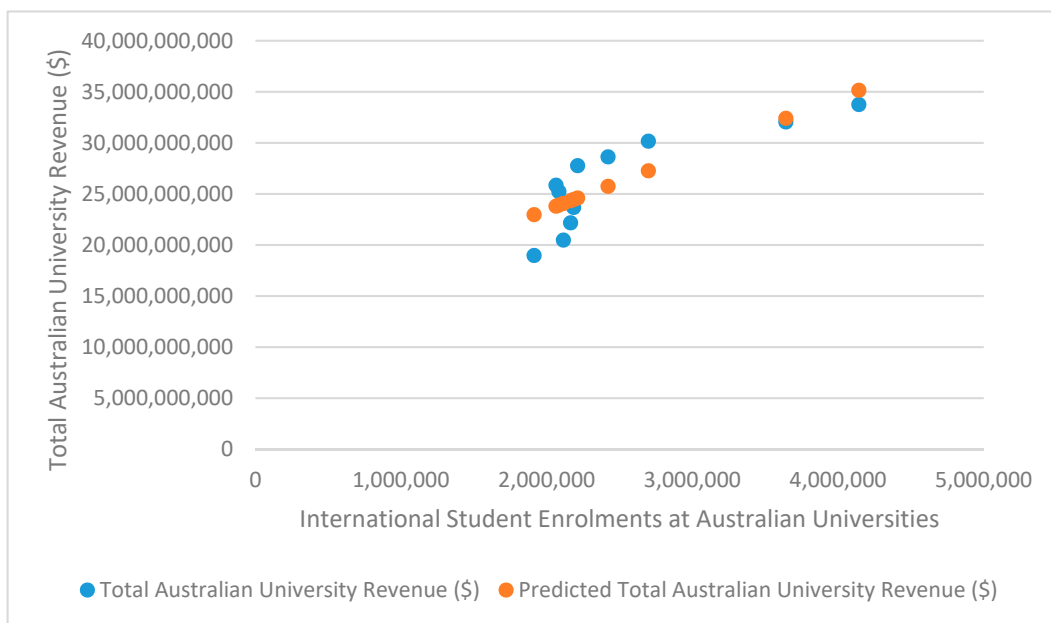


Figure 4. Line Fit Plot for International Student Enrolments and Total Australian University Revenue.

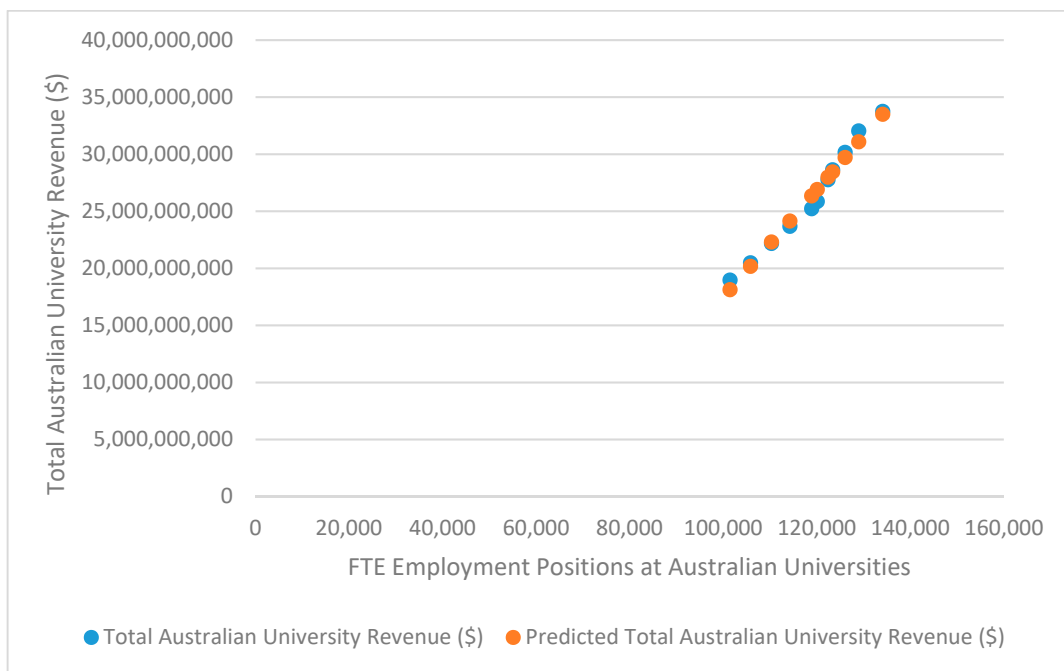


Figure 5. Line Fit Plot for FTE Employment and Total Australian University Revenue.

Based on our data for our three key variables in Table 2, we produced a correlation matrix which can be seen in Table 3. Table 3 highlights that there is a linear relationship between total Australian university revenue and FTE employment positions at Australian universities. This is informed by the positive correlation coefficient of 0.989416939 between these two variables. Similarly, we show that there is a positive linear relationship between total Australian university revenue and the number of international student enrolments at Australian universities, as highlighted by the correlation coefficient of 0.831864998. The *p*-value in Table 3 determines whether the relationship between the dependent variable and independent variables are statistically significant and as such can be used to test our hypotheses.

Table 2. Total Australian University Revenue, FTE Positions, and International Student Enrolment Data.

Year	Total Australian University Revenue (\$)	Full-Time Equivalent Positions at Australian Universities	International Student Enrolments in Australian Universities
2008	18,955,909,000	101,475	1,912,253
2009	20,468,862,000	105,842	2,112,826
2010	22,158,466,000	110,351	2,162,457
2011	23,658,742,000	114,271	2,184,096
2012	25,210,033,000	118,946	2,082,782
2013	25,843,026,000	120,136	2,062,861
2014	27,751,858,000	122,421	2,211,408
2015	28,609,979,000	123,414	2,420,412
2016	30,147,079,000	126,076	3,172,262
2017	32,028,091,000	128,986	3,632,619
2018	33,741,910,000	134,112	4,142,589

Table 3. Results of Correlation Analysis.

Auxiliary Variable	Total Australian University Revenue (\$)	FTE Positions at Australian Universities	International Student Enrolments
Total Australian University Revenue (\$)	1		
FTE Positions at Australian Universities	0.989416939	1	
International Student Enrolments	0.831864998 *	0.776486789 *	1

Significance level * $p < 0.01$.

From our correlation matrix, we utilised a linear regression model to predict the values for the three variables for 2020 and hence, identify if there is any change as a result of COVID-19. For the relationship between total Australian university revenue and international student enrolments at Australian universities, we used the following regression model:

$$\text{Revenue} = 12514853955 + 5457.544235 \times \text{Enrolments}$$

This model shows that when international student enrolments at Australian universities is equal to zero, total Australian university revenue will be equal to \$12,514,853,955. Furthermore, for every one additional international student enrolment, total Australian university revenue will increase by \$5457.544235.

For the relationship between FTE employment at Australian universities and international student enrolments at Australian universities, we used the following regression model:

$$\text{Revenue} = -29703505925 + 471131.9956 \times \text{Employment}$$

This model shows that when FTE employment at Australian universities is equal to zero, there will be a total revenue loss of \$29,703,505,925. For every one additional FTE employee, total Australian university revenue will increase by \$471,131.9956.

Based on the linear relationships we previously established, we used our predicted value for total international student enrolments at Australian universities in 2020 as well as the year to date figures published by the DESE to predict the corresponding values for total Australian university revenue and FTE employment at Australian universities. By running each equation twice; once with our predicted value of international student enrolments for 2020 which does not take into account the effects of COVID-19, and once with actual figures published by the DESE which show the impact of COVID-19, we were able to calculate a range for each variable. Such a range shows the difference between what the predicted value for each variable would be if international student enrolments remain static for the rest of 2020 and the predicted value for each variable if there was no impact from COVID-19. Our predicted value for international student enrolments at Australian universities for 2020 is 4,096,804 and the figure published by the DESE for the year to May is 708,671 (DESE 2020b). As such we made the following calculations:

$$\begin{aligned} \text{Revenue} &= 12,514,853,955 + 5457.544235 \times (4,096,804) \\ &= \$34,873,343,007.12494 \end{aligned}$$

$$\begin{aligned} \text{Revenue} &= 12,514,853,955 + 5457.544235 \times (708,671) \\ &= \$16,382,457,285.56168 \end{aligned}$$

As shown by these calculations, we predict that the value of total Australian university revenue for 2020 will range from \$16,382,457,286 to \$34,873,343,007 (nearest dollar) depending on the effects of COVID-19. Figure 6 highlights these predicted values for total Australian university revenue.

Consequently, if there are no new international student enrolments for the remainder of 2020 then total Australian university revenue will experience a decline of \$17,359,452,714 between 2018 and the end of 2020. This predicted decline subsequently provides evidence to support Hypothesis 1c. Considering that international travel bans will remain in place for the foreseeable future, it is likely that international student enrolments at Australian universities for the second half of 2020 will be significantly lower. We acknowledge, however, that with the rapid rollout of online teaching at the majority of Australia’s universities, it is unlikely that the true value of total Australian university revenue for 2020 will lie close to either extreme of our predicted range. As such, our current findings do not fully support Hypothesis 1b, although the significant decline in international student enrolments indicates that the publication of actual figures in later time periods may support such a hypothesis. In particular, if international student enrolments were to stay at present levels, well below the 10 year average for this variable, then total Australian university revenue would significantly decrease, as indicated by our lower extreme predicted value and in turn support Hypothesis 1b.

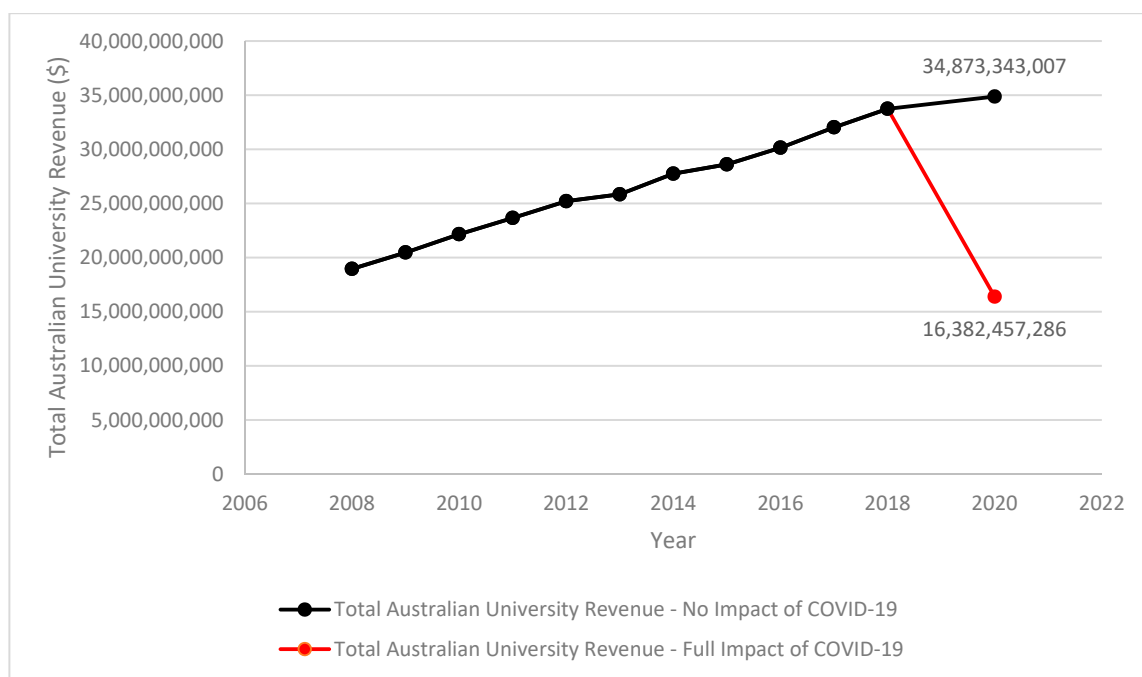


Figure 6. Impact of COVID-19 on Total Australian University Revenue.

In regards to the number of FTE employment positions at Australian universities following the impact of COVID-19, we made the following calculations:

$$\begin{aligned} \text{Employment} &= (34,873,343,007.12494 + 29,703,505,925) / 471,131.9956 \\ &= 137,067.4238540825 \end{aligned}$$

$$\begin{aligned} \text{Employment} &= (16,382,457,285.56168 + 29,703,505,925) / 471,131.9956 \\ &= 97,819.6421405638 \end{aligned}$$

From these calculations, we predicted that the number of FTE employment positions at Australian universities in 2020 will range from 97,820 positions to 137,067 positions (nearest position) depending on the effects of COVID-19. This range of predicted values for FTE employment at Australian universities can be seen in Figure 7. Again, the true value for FTE employment at Australian universities for 2020 is unlikely to reside at the extreme ends of our predicted range, however, it is worth noting that COVID-19 has the potential to cause a loss of 36,292 jobs between 2018 and 2020. Considering the relationship between total Australian university revenue and FTE employment at Australian universities, we used

the predicted range for revenue to help explain the changes witnessed in employment. With total Australian university revenue set to decrease significantly as a result of COVID-19, the follow-on effect is a substantial reduction in the number of FTE positions available at Australian universities. We therefore concluded that the change to FTE employment between 2018 and 2020 can be explained by the impact of COVID-19, which in turn supports Hypothesis 2a. Our results, however, do not yield support for Hypothesis 2b as the predicted decrease to FTE employment at Australian universities does not act as the sole cause of the decrease to total Australian university revenue. In fact, it is more likely that the decrease to total Australian university revenue will be the cause of the decline in FTE employment at Australian universities.

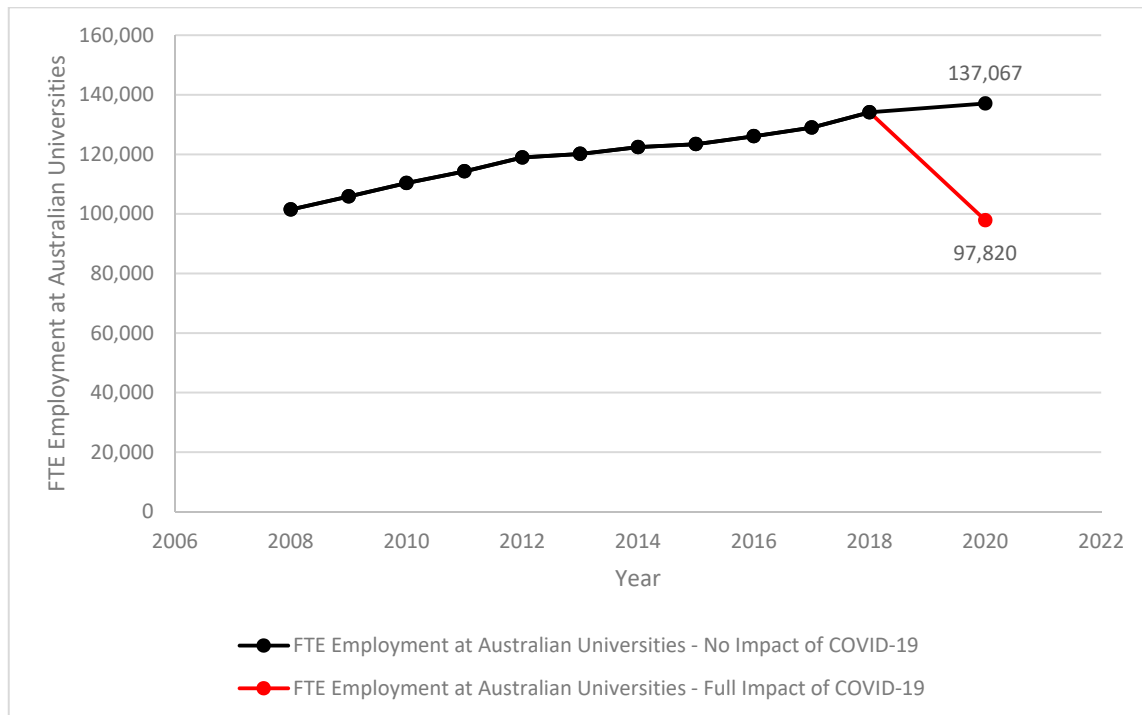


Figure 7. Impact of COVID-19 on FTE Employment at Australian Universities.

5. Discussion

This study was motivated by the limited nature of current analysis and estimations of the impact of COVID-19 on Australia’s education industry. In our study, we have detailed the effect of COVID-19 on three key variables for Australian universities; total Australian university revenue, international student enrolments, and FTE employment positions at Australian universities. In this regard, we investigated the exposure of these variables to the impact of COVID-19 and consequently highlight that they are indeed pressure points that indicate the risk exposure of the broader tertiary education system. With the high level of uncertainty in the current COVID-19 climate, our research provides measurable results that are highly relevant to the present state of Australia’s education industry.

The empirical results of this study confirm the already known negative effects of COVID-19. Previous research only demonstrated the impact of COVID-19 on individual variables such as international student enrolment (e.g., [Hurley and Dyke 2020](#)) and as such provided a limited analysis of the consequences of the pandemic. Our findings therefore extend upon this prior research by providing a range of values for all three variables that demonstrate best-case and worst-case scenarios depending on the number of international student enrolments for 2020. As such, our study acknowledges the impact that each variable has on the others in addition to considering the seasonal impact on international student enrolments. By analysing the three variables in conjunction, we have been able to demonstrate the severe effects that COVID-19 has the potential to cause to Australia’s universities.

Of particular note is the significant loss of total Australian university revenue that could decline by up to \$17,359,452,714 between 2018 and the end of 2020 if there are no new international student enrolments for the remainder of this year. Such a loss reveals the enormity of the financial challenge that confronts Australia's tertiary education sector. Whilst existing research indicates that Australia's universities face a cumulative loss of \$19 billion by 2023 (Hurley and Dyke 2020), we suggest that more than \$17 billion of that could be realised in 2020 if international student enrolments remain static. Moreover, we argue that the current business model of most Australian universities is over-dependent on income generated from international student enrolments and that this has been exposed and exacerbated by COVID-19. This consequently extends the discussion on the exposure of Australian universities to external shocks and questions the sustainability of the current practice of deriving a significant proportion of revenue from international markets. Furthermore, our results have implications for Australia's ability to sustain its export competitiveness in international education, which in turn will affect the path of economic recovery from COVID-19.

With our research revealing the extent to which COVID-19 could impact Australian universities in the immediate term, it is also worth considering the long-term impact of the pandemic. The significant decline in total revenue, international student enrolment, and FTE employment that we predict for Australian universities in 2020 points towards a multi-year recovery effort to return to pre COVID-19 levels. In particular, international student enrolments are likely to remain significantly lower whilst international travel restrictions remain in place. Indeed, research released by the DESE (2020c) demonstrates that the year-to-date April 2020 deferments for international students was 53,075. This represents an increase in the number of deferments by 40,725 from the same period in 2019. The analysis conducted in our study therefore serves as a way of understanding the impact and relationship between the variables, and can be used to contextualise the implications of newly released findings such as those published by the DESE. It should be considered, however, that the growth in online university study globally, not just in Australia, is likely to partially offset this increase in deferments. With face-to-face teaching at universities all around the world proving to be problematic, international students may grow accustomed to completing their degrees online and hence result in an increase in enrolments for the latter part of 2020 or early 2021. Nevertheless, the possibility remains that international students may choose to study at institutions outside of Australia given current border restrictions, which in turn will have serious economic consequences for Australia's education industry. Additionally, we argue that the significant decline in international student enrolments not only has negative consequences for the revenue generated by individual universities but it is also problematic for the broader performance of Australia's international education sector over the short-to-medium-term. With international education being Australia's fourth largest export in 2019, our findings suggest that the impact of COVID-19 will cause a significant decline in the performance of this sector.

As shown by our results, FTE employment at Australian universities is an area that will be majorly affected by the loss of revenue and international student enrolments. Furthermore, employees of Australian universities have been further disadvantaged by their ineligibility to access the federal government's JobKeeper wage subsidy program. Our results therefore take on added significance, as university employees who lose their job may struggle to find income support whilst they look for new work. The prevalence of short-term or fixed contracts for many of these workers has made them particularly prone to layoffs resulting from COVID-19. The fact that employee costs account for the greatest proportion of university spending also means that a significant decrease in the number of FTE positions will be the first stage of the restructuring process for Australian universities to minimise the economic effects of COVID-19. The findings of our research suggest that up to 36,292 FTE positions will be lost by the end of 2020 alone, with the possibility for further layoffs depending on the speed of the recovery process. Such layoffs raise concerns over the quality of tertiary education offered by Australian universities in the future as well as the impact to the output and rigour of academic research. The importance of tertiary educated workers to the productivity of Australia's workforce

and the guidance that current academic research provides to policy direction leads us to point out the importance of minimising the number of job losses in this sector.

Whilst the findings for our hypotheses pertain largely to Australian universities, other aspects of our study hold relevance to academic institutions in other countries around the world. First and foremost, the decline in international student enrolments is an occurrence likely to be common to the majority of universities around the world as students remain in their home countries due to travel restrictions. As such, our results for Hypothesis 1a can be seen to be more general and applicable to other countries besides Australia. Whilst the 10 year average for international student enrolments will differ between countries as will the rate of decline caused by COVID-19, the general premise should hold true, particularly for Western nations similar to Australia such as the UK and US. The results for Hypothesis 1b on the other hand are more country specific to Australia, as it assesses the impact of COVID-19 on the growth rate of total Australian university revenue compared to 2018. Although our results could not definitively support Hypothesis 1b as we predict a range rather than a definitive value for total Australian university revenue, we show that Australia's tertiary institutions are likely to face severe financial difficulty in the near future. In regards to Hypotheses 1c and 2a, their generic nature means that they are applicable to countries other than Australia. Our results consequently indicate that the number of FTE positions at universities around the world will decrease as universities look to streamline their cost structures by reducing the number of staff. For Australian universities, utilising debt finance to sustain current operations remains an option despite the increased cost of borrowing, however, this will not be the same for other countries. It therefore becomes evident that our results indicate the difficult state of international tertiary education, not just for Australia but for other countries as well.

Our research provides practical insights for policy makers and university decision makers in Australia. By demonstrating the significant decline in total Australian university revenue, international student enrolment, and FTE employment at Australian universities we have been able to quantify the short-term impact of COVID-19. In particular, the over-dependence on international student enrolment for the growth of Australian university revenue is an area of deep concern, given the high levels of uncertainty in the global economy. This not only places Australian jobs at risk but also has severe implications for one of Australia's key exports. Our study consequently provides policy makers and university decision makers with real time findings that demonstrate the potential impact of COVID-19. From this it becomes apparent that Australian universities and the education sector more broadly is set to face significant financial challenges that need to be carefully navigated to avoid further losses.

6. Limitations and Further Research

Making predictions from our statistical analysis for total Australian university revenue and the number of FTE equivalent jobs at Australian universities in 2020 warrants the need to acknowledge the limitations of our study. Whilst making these predictions enabled us to clearly map out the impact of COVID-19 on international student enrolment, total Australian university revenue, and Australian university employment, it ultimately limits the applicability of our study. More specifically, the recency and scale of COVID-19 means that current data published by the DESE does not reflect its effects. As a result, we have extrapolated outside the range of our data for total Australian university revenue and FTE employment at Australian universities in order to make our predictions. We have subsequently included multiple checks of our data to assess its suitability for linear regression and to improve the overall robustness of our study. This included checking that the residuals were not correlated with our predicted values and that the residual variance remained constant across all our predicted values. More details of these checks can be found on pages 8 to 10. For policy makers and university decision makers, it is important to note that these predicted values are as accurate as current information and publications allow, but that they may differ from the actual values reported in subsequent time periods. Furthermore, this study being completed in June 2020 can only make a premature assessment of the relationship between the variables in the wake of COVID-19. For more accurate and extensive

analysis, data for at least the entire 2020 academic year and ideally 2021 would be used to investigate the long-term impacts that COVID-19 has had on Australian universities. We therefore suggest that further areas of research could include the impact that COVID-19 has had on total student enrolments, both domestic and international, and the subsequent effect this has on funding for academic research. Also of relevance would be investigating the current role that Australian universities are playing in sustaining economic growth whilst other industries are operating below capacity. The growth of online study for Australia's tertiary institutions is another area that is yet to be well documented, with figures for the number of courses offered online during Semester One of 2020 by Australian universities yet to be published. Of note would be investigating whether the courses offered online during the current pandemic will become part of the core offering of Australian universities in the future or whether they are just a temporary fixture to accommodate the constraints imposed by COVID-19.

7. Conclusions

COVID-19 is set to severely impact Australia's universities and the broader education industry. Our research investigates the impact of COVID-19 on three key variables; total Australian university revenue, international student enrolment in Australian universities, and FTE employment at Australian universities. Through the use of correlation analysis and regression analysis we show that our three key variables are likely to significantly decrease in 2020 due to the effects of COVID-19. More specifically, we use the 708,671 international student enrolments reported by the DESE for 2020 to predict that there will be a loss of up to \$17,359,452,714 in total Australian university revenue whilst the number of FTE employment positions at Australian universities will decrease by up to 36,292. As such, we provide a discussion on the significant exposure of Australian universities to the effects of COVID-19 and point to their dependence on revenue coming from the enrolments of international students as a key reason for such exposure. Our study therefore adds to the growing research on the effects of COVID-19, with a specific focus on demonstrating the adverse impact on Australia's universities.

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