Why the real wages of graduates with bachelor's degrees have fallen

Prepared by Patrick Hartigan and Jonathan Hambur[*]

The real average wages of graduates with bachelor's degrees have fallen over the 2010s. This period also coincided with the 'demand-driven' reforms to higher education funding. We test whether the decline in real average wages was due to changes in the composition of graduates after the reforms. Using causal forests, we adjust for changes to the cohort of bachelor's graduates after the reforms and find evidence that changes in the demand for, and supply of, graduates accounted for much of the decline. For demand, adjusted graduate wages moved in line with local labour demand. For supply, outcomes were worse in labour markets with the largest increases in the number of graduates post-reforms. Changes in the characteristics of people graduating does not appear to explain the fall in real average wages.

Education and training reforms are often proposed to increase productivity growth

Australian policy makers often propose reforms to education or training to increase labour productivity and, in turn, wage growth. However, research into the impact of previous Australian education and training reforms on labour markets is sparse and has been limited by a lack of appropriate data.

In this article, we focus on the shift to demand-driven higher education funding, one of the most significant federal government education reforms in the 2010s. We investigate the relationship between this reform and falling average real wages for bachelor's degree graduates over the same period.[1]

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[1] From here on, 'graduates' refers to bachelor's degree graduates, unless specified otherwise.

We test whether changes in characteristics of the graduate cohort explain the fall in graduates' real average wages following the reforms. This has implications for the appropriate policy response to the decline in wages for this cohort, and the design of future higher education funding.

Higher education reforms coincided with a fall in real wages for graduates with bachelor's degrees

Wage growth for younger workers was weak over the 2010s, with real wages for people aged 18 to 34 declining between 2008 and 2018 (Productivity Commission 2020). The decline in real wages was particularly large for those with a bachelor's degree. In real terms, people who graduated in 2009 earned more on average in each of the first 5 years post-graduation than those who graduated in 2013 (Figure 1).

Figure 1: Real average wages for bachelor's degree graduates
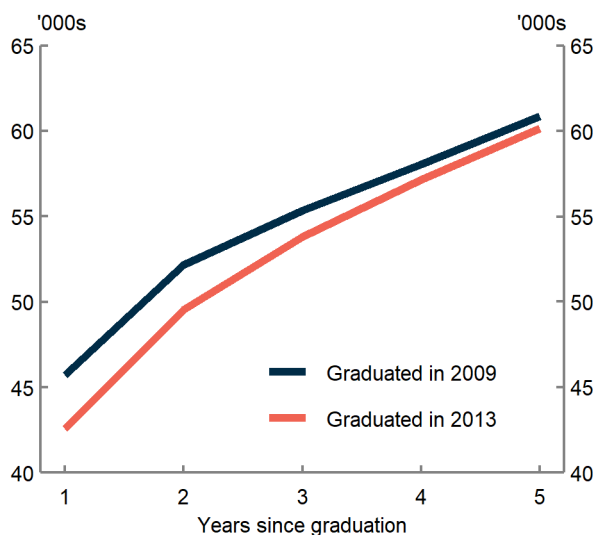
Figure 2: Share of bachelor's graduates with an ATAR equal to or less than 60
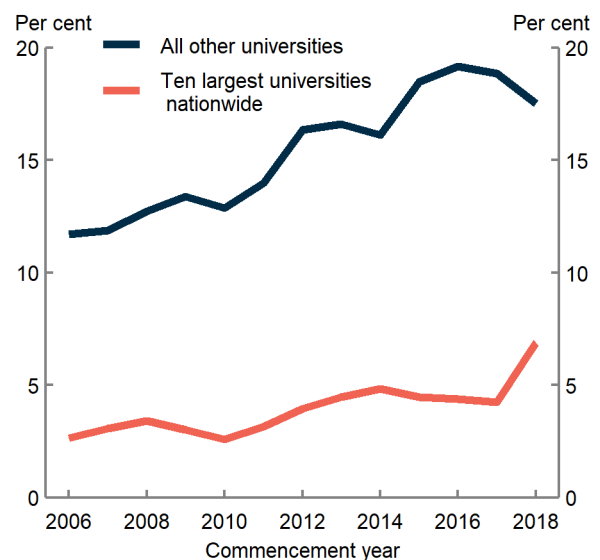
Notes: Figure 1 is in 2021 AUD. In Figure 2 ten largest universities are 10 universities nationwide with high median ATAR for bachelor's graduates and large enrolment.
Source: Treasury analysis using the ABS DataLab, including HEIMS data from the Department of Education and personal income tax filings from the Australian Tax Office.

One potential cause of poorer outcomes for graduates is the introduction of a demand-driven model for higher education funding which was phased in from 2010. The reforms led to a substantial increase in bachelor's degree enrolments − from around 195,000 in 2009 to 260,000 in 2015 − and improved access for people from under-represented groups.[2]

The composition of graduates differed before and after the reforms. For example, many of the additional graduates who attended university after the reforms had on average lower ATAR scores

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[2] The reforms were implemented in response to the Bradley Review and aimed to improve equity of access to higher education and to ensure there would be enough bachelor's degree graduates to meet the modern economy's needs (Productivity Commission 2019).

(Productivity Commission 2019; Figure 2). This may reflect a lower earning potential in the types of roles that require bachelor's degrees. We separate out this effect from other potential explanations by comparing wages for students with similar characteristics before and after the reforms.

Data on Australian bachelor's degree graduates

We use anonymised data on graduates' characteristics, incomes and locations from the Higher Education Information Management System (HEIMS) accessed via the ABS. This dataset provides detailed information about graduates' educational characteristics, including tertiary entrance score, field of study, tertiary education institution, and personal characteristics. We also have information on graduates' salaries and estimates of their location and commuting zone from the ATO and Bureau of Infrastructure and Transport Research Economics (BITRE). The full list of variables in our models is in Table 1.

We compare wage outcomes for a sample of domestic students who graduated in 2009 and 2013 in our main results, and 2009 and 2014 as a robustness test. Our dataset includes graduates who were not employed (had no wage income on their personal income tax filing or did not file income tax in a year) and who re-enrolled. Given its importance for earnings, we exclude graduates for whom we have no location data. Our sample includes approximately 75,000 bachelor's degree graduates from each of the 2009, 2013 and 2014 cohorts, a substantial majority of the graduates in each cohort.

Table 1: Variables included in model of 'macro effects'

Variable	Selected in final model?	Source
Institution	9 institutions	HEIMS
Attended one of 10 largest institutions	Yes	HEIMS
Field of education	12 fields	HEIMS
Gender	Yes	HEIMS
LOTE	Yes	HEIMS
Born overseas	Yes	HEIMS
Self-identified disability status	Yes	HEIMS
ATAR score	Yes	HEIMS
State/Territory	Yes	ATO
Commuting zone	6 commuting zones	ATO and BITRE
Lives outside a capital city	Yes	ATO
Lives in one of 10 fastest growing labour markets	Yes	ATO
Lives in one of 50 fastest growing labour markets	Yes	ATO
Whether graduate re-enrolled	Yes	HEIMS

Notes: Variables selected by model of macro effects. Institution, field of education and location (commuting zone) are converted into dummy variables. The model has selected only some institutions and commuting zones. Models estimated as per Wager and Athey (2021). Source: Treasury analysis using the ABS DataLab.

We use machine learning to control for compositional changes and isolate the demand and supply impacts on wages

We compare outcomes for 2013 graduates (post-reform) who have very similar educational and personal characteristics to 2009 graduates (pre-reform) for the first 5 years following graduation. This provides us with an estimate of how wages would have changed if the characteristics of the graduate cohort had remained the same. We can then separate observed wage changes due to changing graduate characteristics (cohort characteristics effects) from those that reflect change in the supply of or demand for graduates (macro effects).[3]

The macro effects can also be thought of as the extent to which the same person at the same point in their career would be paid differently pre- and post-reform. Someone who studied quantitative finance, for example, would have likely earned more in their first job if they graduated before the GFC than if they graduated immediately after it.

Our main results use a machine learning technique known as causal forests. Calculating the degree of similarity between students is difficult with so many variables on students' educational and personal backgrounds. Causal forests are a data-driven way of identifying similar students from before and after the reforms. The approach helps identify which of the more than 700 variables available (including interactions) that could drive wage outcomes are most important for identifying students that are similar pre- and post-reform (Table 1). In this way, the causal forests technique has the advantage of not needing to pre-judge which of the variables to include.[4]

Macro effects account for most of the decline in real wages

Average real wages for the 2013 cohort were on average 3.5 per cent below real wages for 2009 graduates over the first 5 years post-graduation. In the first year, post-graduation, around one-fifth of this was due to the changing characteristics of graduates (cohort characteristics effects), as shown by relative sizes of the dark and light blue bars in year 1 (Figure 3). The remaining four-fifths reflect macro effects: changes in supply of and demand for graduate labour. In the following years, the cohort effects are small and statistically insignificant, while macro effects continue to weigh on graduate wages.

These results are robust to changes in model choice, for example using a propensity score matching model with variables selected via an elastic net. The results also hold if we use 2014 graduates instead of 2013 graduates as the post-reform cohort.

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[3] One of our key assumptions is that macroeconomic conditions do not affect the cohort of graduates, beyond whether to re-enrol in university post-graduation, which we account for in our model.

[4] We estimate the causal forest models as per Athey and Wager (2021). For a more technical discussion about causal forests, see Athey, Tibshinrani and Wager (2019).

Figure 3: Decline in graduates' real wages due to macro and cohort characteristic effects, 2013 versus 2009 graduates[5]
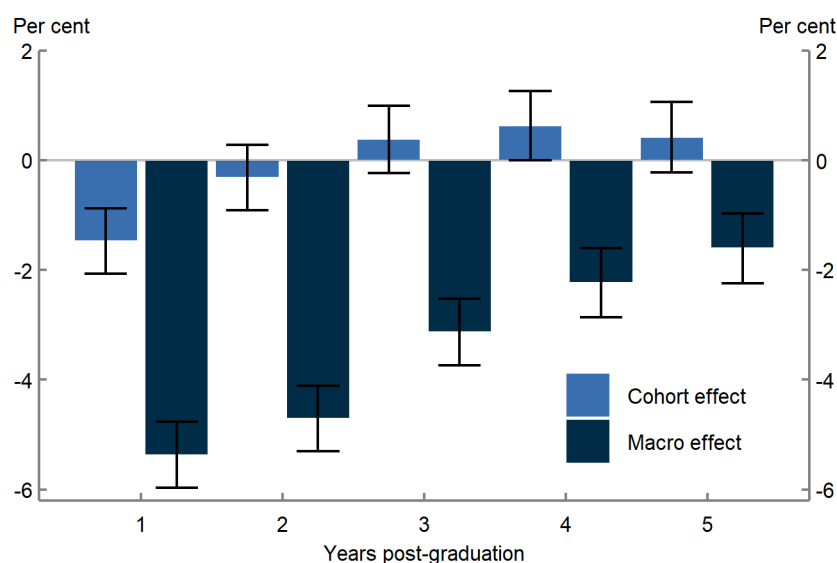
Notes: Dark blue bars and black error bars show mean estimate of macro effects on real wages and 95% confidence interval, respectively, for all graduates, 2013 versus 2009. Light blue bars and black error bars show estimated cohort effects, calculated as (unconditional) total effect minus estimated macro effect, and 95% confidence intervals, 2013 versus 2009.
Source: Treasury analysis using the Labour Market Tracker, including HEIMS data from DESE and personal income tax filings from the ATO.

Greater supply of graduates is correlated with lower adjusted graduate wages in local labour markets

We now turn to exploring whether demand or supply factors are driving the macro effects identified above.

If the increase in supply of graduates was a key factor, we would expect to see greater real wage declines in locations and fields with the greatest increase in graduates. As such, we identify the 50 fastest growing local labour markets − the commuting zones and academic fields with the highest growth in graduates by 2018 − and estimate whether the compositionally adjusted wage declines (macro effects) were more pronounced.[6] Local labour markets that grew the fastest had larger adjusted graduate real wage declines in the first 2 years (green error bars, Figure 4), although this had dissipated by the third year.[7]

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[5] Graduates have become more likely to re-enrol in post-graduate study since the reforms. This compositional change is likely to have had a negative effect immediately following graduation, as more graduates re-enrol rather than enter work, and become positive as these graduates enter the workforce after their further studies.

[6] The analysis is robust to using markets that grew faster than average, and the 10 fastest growing labour markets. We exclude very small markets with fewer than 500 graduates in 2011.

[7] If between 2009 and 2013 the distribution of graduates across subjects changed because of expectations of higher/lower future wage growth, our macro effect estimates would be understated and would not include these *anticipated* macro effects.

The short-lived nature of the decline suggests that the increased supply of graduates may have lowered wages by making it more difficult for graduates to match with roles that suit their interests and skills. Over time this effect dissipates as graduates move to better-suited jobs.

Figure 4: Macro effects on real graduate wages, 50 fastest growing local labour markets compared with everywhere else, 2013 versus 2009 cohorts
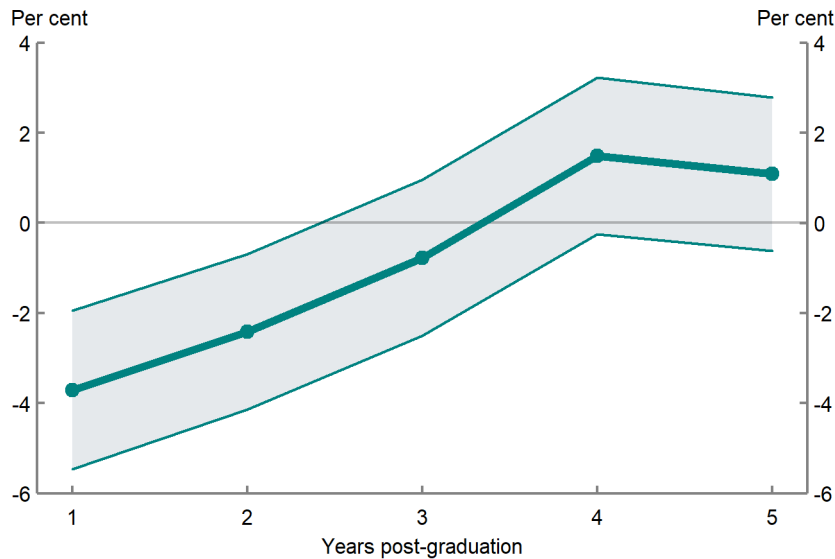

Notes: Green dots and error bars show coefficient estimate and 95% confidence interval from regression of estimated macro effects for the fifty fastest growing labour markets, 2013 versus 2009 graduates.
Source: Treasury analysis using the Labour Market Tracker, including HEIMS data from DESE and personal income tax filings from the ATO.

Adjusted graduate wages appear to have moved in line with broader labour demand

There is also evidence that demand played a role in graduates' real wage outcomes. For example, compositionally adjusted real wages declined in regions where labour markets were weakening, like Western Australia, as the mining-construction boom ended (Figures 5 and 6). In Victoria, where labour markets were strengthening, the macro effect real wage penalty for men disappeared. This evidence suggests that after controlling for cohort characteristic effects, the decline in graduate wages was associated with the broader weakness in labour demand.

Figure 5: Macro effects on male real graduate wages in Victoria and Western Australia, 2013 versus 2009 cohorts
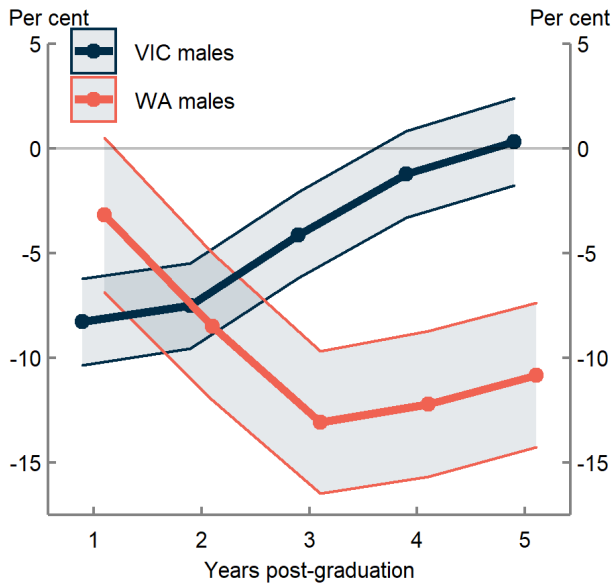
Figure 6: Employment to population ratio – Victoria and Western Australia
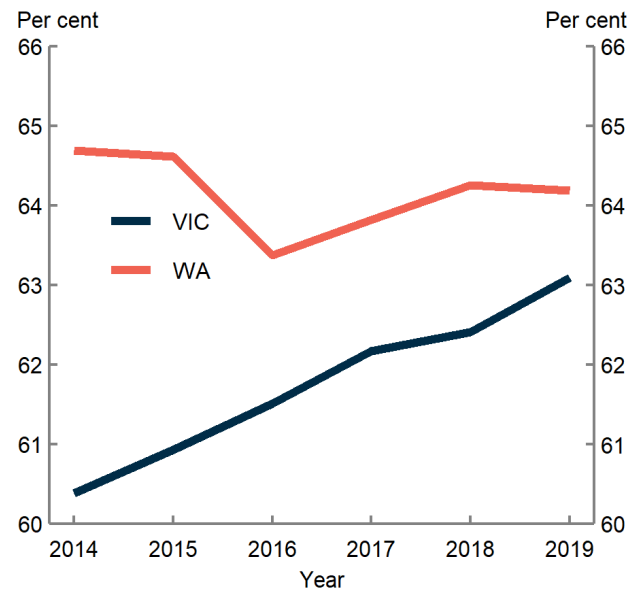
Notes: Green dots and shaded areas in Figure 5 show average real wage macro effects and 95% CI for men in WA and VIC, 2013 versus 2009 graduates.
Source: Treasury analysis using the Labour Market Tracker, including HEIMS data from DESE and personal income tax filings from the ATO.

Conclusion

We find that the decline in real average wages for bachelor's degree graduates over the 2010s is largely explained by macro factors, rather than changing characteristics of students. With respect to the demand for bachelor's degree graduates' labour, our results are consistent with earlier Treasury working papers which show the sensitivity of graduates' labour market outcomes to broader labour market conditions (Andrews et al. 2020). Both pieces add to evidence of the importance of macro stabilisation policies given the potential for long-run labour market scarring for young workers entering a weak labour market.

On the supply side, our findings are consistent with the hypothesis that increases in the number of university graduates increased competition for skilled jobs and, in turn, were partly responsible for young people's falling wages (Productivity Commission 2020). This highlights the importance of ensuring any future skills and higher education policy interventions that go beyond supporting informed student choices are well targeted towards sectors with growing demand for skills; for example by using the National Skills Commission's Skills Tracker. In neither case, however, did changes in the *characteristics* of people graduating drive the fall in real wages.

References

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