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Course Choice and Achievement Effects of a System-wide Vocational Education and Training Voucher Scheme

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Abstract

Vocational education and training provision for young people is a crucial but often maligned part of the wider education sector. A common criticism, and motivation for numerous reforms across countries where training is predominantly classroom-based, is that too much training is low quality and unrelated to skill needs. This paper examines the effects of a major Australian reform – replacing a centrally-planned model with a system-wide voucher scheme – aimed at addressing these weaknesses. The reform led to large increases in private college enrolments, improved match between course choice and employer demand, and improved student achievement, with no adverse impact on equity.

1. Introduction

Post-secondary VET provides young people, including early school leavers, with accessible opportunities to continue education beyond school. Positive spillovers and borrowing constraints are among the motivations for extensive public funding of the sector (Stevens 1999). A major challenge for government; however, is allocating public funding in a way that promotes training that is high quality and relevant to skill needs. This is most acute for VET in countries, such as the United States, England, New Zealand and Australia, where the allocation of funding to VET is mostly *not* linked to the attainment of employment (apprenticeships). Instead, post-secondary VET in these countries is predominantly classroom-based training in public colleges with complicated and over-lapping funding arrangements that have been subject to frequent and often piecemeal reform.[1] Recent assessments of these VET systems, which in part blame existing funding models for persistent skill shortages and poor-quality training (e.g. Wolf, 2011; US Department of Education, 2012), suggest in some cases that the challenge remains unmet.

Part of the problem is that there are strongly held beliefs on all sides about the extent to which, and how, market mechanisms should be employed in allocating public funding to VET providers. This is exacerbated by difficulties in comparing institutional impacts on outcomes across countries[2] and a lack of credible quantitative evaluations of past VET reforms within countries. To begin to fill this gap, this paper uniquely provides detailed evidence on the impacts of a 'big-bang' system-wide reform that introduced market mechanisms to post-secondary VET. Specifically, this paper examines impacts of a major national reform in the Australian state of Victoria – introduced earlier than in other Australian states – that replaced a centralised supply-driven funding model with a broad-based voucher scheme that linked funding to student course choice, including the choice of courses with private colleges. By quantifying the impacts of market-based reforms in Victoria, this study will help build an

evidence base to inform reforms elsewhere; without which, it is difficult to build a case, execute and maintain reforms in the face of opposition from vested interests. In Victoria, industry, public colleges and the media all cast doubt about whether the reforms could lift training quality and alleviate long-standing skill shortages.[3] Due in part to the negative media, voucher schemes subsequently introduced in other Australian states included restrictions on course choice.

As far as we are aware, this is the first study to estimate the impacts of a broad-based voucher scheme in VET on training relevance, measured as the alignment of course choice with information available on skill need, and academic achievement, a proxy for quality. Previous studies on the impacts of VET voucher schemes (Schwerdt et al., 2012; Hidalgo et al., 2014) examined small-scale targeted programs that complemented existing VET funding systems and therefore provide little guidance on the likely outcomes of system-wide reforms. Whether these reforms improved life-time earnings is outside the scope of this study, mainly because the data required are not currently available.

This study also makes an important general contribution to the wider educational voucher literature by examining whether institutional characteristics that are supportive of disadvantaged groups are sufficient to ensure that any positive course choice and achievement impacts are widely shared. In the main, evidence to date on school choice reforms points to benefits that are not shared equally (see Epple et al. (2015) for a review). One explanation is that disadvantaged groups don't benefit because of selection effects (by schools and families) that increase segregation (Hsieh and Urquiola, 2006). Another is that they have difficulty accessing and utilising information on available education options (Levin, 1991; Ladd, 2002; Hastings and Weinstein, 2008). Under the conditions examined in this study there is little scope for selection — admission to a VET course is on a first-come-first-served basis, with restrictions on cream-skimming and fee caps — and information on skill needs (skill shortages)

is easily understood and freely available online. At least some of these characteristics are replicable in other educational contexts.

The remainder of the paper is set out as follows. Section 2 provides institutional details for the VET sectors in the rest of Australia and for Victoria pre and post-reform. Section 3 briefly discusses potential mechanisms for reform impacts. Section 4 describes the data and defines the outcome measures. Section 5 discusses the empirical approach and related identification issues. Sections 6 and 7 discuss the findings relating to course choice and educational achievement, respectively. Section 8 discusses sensitivity analysis and Section 9 concludes. Additional data details and results are presented in a Supplementary Appendix.

2. VET in Australia and the Victorian Training Guarantee (VTG)

The Australian schooling system is similar to other English-speaking countries in that the student body is unstreamed and the upper-secondary curriculum is geared towards preparation for university study (study that leads to a 3-year bachelor degree). For those who do not have the academic credentials or desire to attend university, including the 20% who leave school without attaining an upper-secondary school qualification (Australian Bureau of Statistics, 2016), VET is the main avenue to acquire post-school qualifications. The rate of participation is high, with around 40% of young people enrolling in a post-secondary VET course by age of 25 (Polidano and Ryan 2016).

Compared to university study, post-secondary VET courses are highly heterogeneous, with around 1,500 nationally accredited courses available at different levels (International Standard of Education Classification (ISCED) 1997 level 2C, 3C, 4B and 5B) geared towards preparing students for specific occupations. To attain qualifications students must demonstrate minimum competency in performing general and job-specific tasks that are prescribed in national training packages. National training packages are assembled by national skills councils that comprise representatives from government and employer groups. Except for apprenticeships and

traineeships (which require an employment contract) there is no requirement in training packages for competencies to be met through workplace learning. At present, there is no grading of students to gauge the level of skill proficiency attained beyond pass/fail. Although minimum training standards are set at a national level, each of the six states and two territories is responsible for funding and administering their own VET sector.

Historically, states used a centrally-planned model for funding VET, one where fixed budget allocations were made at the course level across public providers (Technical and Further Education colleges (TAFEs), Adult and Community Education (ACE) centres and dual sector universities) based on historical enrolments and skill forecasts. Because VET is highly modularised, enrolments commence throughout the academic year and the limited numbers of places available pre-reform were rationed on a first-come-first-served basis. In practice, students could apply to multiple courses at multiple colleges at the same time and accept their offer of choice. Students who missed out on an offer from their preferred course at their preferred college could accept a place in the same course at a less preferred college, a less preferred course in their preferred college or re-apply the following year. There were no restrictions on the number of applications that could be made. As part of national reforms in 2008, all Australian states agreed to introduce demand-driven models where funding follows student choice. Victoria was the first state to implement these reforms from July 1 2009, which for 15-19 year-olds went by the name of the Victorian Training Guarantee (VTG).[4] Until July 2012 when South Australia introduced its own reforms, all other states continued to operate their centrally-planned funding models.[5] The Victorian reforms therefore represent a unique natural experiment on systemic VET reform which can be evaluated using standard difference-in-differences methods. Note these reforms covered all age groups, but were most extensive for 15-19 year olds – the age group for which engagement in post-secondary VET is most common – on whom this paper focuses.

In essence, the VTG triggered three changes: the uncapping of the number of publicly-funded places available to 15-19 year-olds, the linking of funding to student choice rather than provider capacity and government target areas, and the introduction of additional competition for funding from private colleges. By uncapping the number of publicly-funded places, individual providers were free to decide on the number of course admissions. The VTG did not affect public funding of the classroom component of apprenticeships and traineeships, which from 1998 had operated under a separate demand-driven system, including the freedom for employers to choose training with private colleges.[6] During the period of analysis, all other arrangements remained much the same for 15-19 year-olds in Victoria (and elsewhere), including the course subsidy levels and the process of course admission described above.[7]

An additional interesting aspect of this reform, in contrast to educational contexts where broad-based vouchers have been introduced previously, is that there are strong regulatory safeguards in Australian VET that aim to ensure equality of access. First, during the period of analysis, the ability of providers to raise prices in response to increased demand was limited by fee caps for publicly-funded VET courses that typically restricted fees charged direct to students to less than A$1000 per year for a full-time course.[8] A potential downside of the price caps is that they may have dampened the incentive for colleges to innovate in response to increased competition and instead encouraged cost cutting and reduced training quality, although minimum training standards are set centrally and there is a monitoring system in place. Second, colleges have limited ability to cream-skim because there is little personal information made available in advance to providers on which to select students – open access is a defining feature of the Australian VET sector – which means that admission is typically made on a first-come first-served basis. Further, the incentive to cream-skim is reduced by registration requirements that compel colleges, including private colleges, to comply with

equity principles.[9] Depending on the circumstances of the student, extra subsidies are also available to colleges to meet the extra cost of catering for 'high needs learners'.

Students who miss out on a subsidised place in training can enrol in an unregulated and unfunded 'fee-for-service' VET course, for which private colleges compete alongside public colleges in all states, although few 15-19 year olds take this route and consequently they are not part of the administrative collection used in this study. The best available data from the Longitudinal Survey of Australian Youth (LSAY), a large nationally representative survey of 15 year-olds (in 2003) tracked annually to age 25, suggests that private fee-for-service enrolments prior to the VTG (2005-07) represented at most 9% of all 17-19 year-old VET enrolments.[10]

3. Potential Mechanisms

Course choice and educational achievement (in this case completion) can be thought of in terms of an underlying discrete-choice human capital framework in which potential students make enrolment decisions, and decisions to stay the course given initial enrolment, based on their perception of the expected course benefits and costs. Such a framework suggests several mechanisms through which the VTG might impact on course choice and achievement, including compositional changes in the student body, compositional changes on the supply side (Friedman, 1962; Anderson, 2005; Blochliger, 2008; Bettinger et al., 2010; Demming et al., 2012; Rosenbaum and Rosenbaum, 2013), differences between students and government in the information used to assess labour market needs (Lavy, 2006; Jensen, 2010; OECD, 2010), disproportionate student weighting of consumption benefits of VET (Oreopoulos & Salvanes, 2011; Baker et al., 2017), competition impacts on quality and other aspects of provision (Friedman, 1962; Hoxby, 2003; Anderson, 2005; Figlio and Hart, 2014; Böhlmark and Lindahl, 2015), and, for achievement, knock-on effects of VTG-induced changes in course choices and match quality (Bound and Turner, 2011). Additionally, there may be less scope post-reform for

funding allocations to be affected by inertia on the part of policy makers or lobbying by incumbent providers.

Together these potential mechanisms point to VTG impacts of uncertain sign on both outcomes, hence the importance of credible empirical evidence. As part of our empirical strategy, we first estimate the overall reform effect – the net effect of all these mechanisms – using difference-in-differences estimation, before exploring the role of these individual mechanisms by adding additional controls that proxy them in a step-wise manner.

4. Data

The main dataset used in the analysis is the VET Provider Collection (VETPC), an annual administrative dataset containing the population of all VET enrolment activity in Australia, except for fee-for-service enrolments with private colleges. The VETPC contains detailed course, student and college information, and a unique student-course identifier that allows enrolments to be tracked across time and, in most cases, through to completion.

The sample consists of all new enrolments among 15-19 year-olds – as of January 1st in the year of enrolment, which determines VTG eligibility – who are no longer in secondary school and who commenced study in 2006 to 2009 (pre-reform) or 2010 to 2012 (post-reform). 2009 is treated as pre-reform despite the fact that the reforms were introduced in July 2009 because most enrolments occur at the start of the Australian academic year, i.e. January/February. Also note that post-reform counterfactual outcomes are potentially affected by the introduction of South Australian VET reforms in July 2012. Sensitivity to excluding both periods is examined in section 8.

Table 1 summarises new enrolments in the sample. Enrolments in Victoria grew from 62,179 in 2009, the final pre-reform period, to 116,015 by 2012, an 86% increase. In contrast, there were only minor increases in enrolment in the rest of Australia over this period — from 160,718 in 2009 to 165,167 in 2012, or a 3% increase. Importantly, some of the courses that

experienced the largest enrolment increases (more than 500 enrolments annually) were in areas of national skill shortage; including courses that prepare students for work as child care workers, plumbers, hairdressers, electricians, cooks and child care managers (Table A5 in the Supporting Material). The growth in the number of enrolments in Victoria over this period is evenly split between public and private colleges, although private enrolment growth is from a much lower base. The decline in private college enrolments in both Victoria and the rest of Australia in 2008 is due to a decline in new apprenticeships related to the slowing of GDP growth that coincided with the global financial crisis. Note there is no noticeable increase or decrease in post-announcement but pre-reform enrolments in Victoria (August 2008-June 2009), which otherwise might suggest anticipation effects.

Table 2 presents sample means for student, college and course controls used in the analysis. Note there are only minor pre-reform differences in student characteristics between Victoria and the rest of Australia. Also note that the huge increase in enrolment in Victoria over this period was not drawn disproportionately from any one socio-economic or demographic group, with only minor impacts on a wide range of observed student characteristics.

4.1 Outcome variables

VTG impacts are examined on two key outcomes: the alignment of course choice with skill demand, and academic achievement, here interpreted as a (conditional) proxy for training quality. For course choice, two measures of 'fit' with labour market needs are derived using external data sources that are linked to course choices in the VETPC. Each year of the analysis, course enrolments are linked to information on labour market needs available at the start of the year (when most enrolments are made). In using the latest information available at the time of enrolment, the implicit assumption is that students make naïve forecasts of course outcomes based on current course information (Ryoo and Rosen, 2004; Heckman et al., 2006).

The first measure of labour market needs is a binary indicator for whether the occupation the course is designed to prepare students for is on a national skills shortage list.[11] Skill shortage lists are prepared annually (usually published in August) by the federal government, based primarily on employer surveys and skill forecasts. Over the period of analysis, around 10% of all occupations were identified as being in national shortage, although there were distinct changes in the occupations and number of occupations on the list. The 2009-10 list, which is the one available at the start of 2010, listed around half the number of occupations compared to the previous year, reflecting the slowing of growth in Australia following the onset of the global financial crisis. When using the skill shortage measure, the analysis excludes around 10% of enrolments that are in general and mixed field courses, such as numeracy and literacy and employment skills courses, that are not designed to prepare students for a particular occupation.

The second course choice measure is a continuous variable constructed from estimated earnings premia associated with the most recent graduates in each national qualification level and field of study combination.[12] These are estimated using annual earnings data from the Student Outcomes Survey (SOS), a large and nationally representative survey of VET graduates conducted in the year following course completion.[13] The sampling frame for the SOS is the population of VET completers in the preceding year drawn from the VETPC dataset described above, and includes updated information on student characteristics and current labour market outcomes, including weekly earnings for those employed.[14] Specifically, these data are used to estimate a log wage regression for completers aged 15-25 years at the time of survey on dummies for course-level and field-of-study combinations, with resulting coefficients interpreted as the average expected earnings premia from different course choices, conditional upon observed student controls and on finding employment in the year after study. It is important to point out that although the continuous nature of this measure may better

capture the extent of skill demand, course-level graduate earnings information was not readily available to students during the period of analysis.

The VETPC data are also used to construct two measures of *completion* which, given VET qualifications in Australia are pass/fail, are the only available measures of educational achievement. The first completion measure is a binary indicator equal to 1 if the student has passed the course by the end of the year following entry, and 0 otherwise. Those who enrol in the first half of the year are therefore tracked for 18-24 months, which is beyond the typical course duration of 12-18 months. Some of those who enter in the second half of the year are tracked for less than 18 months, and some of these are treated as right censored given that the data do not distinguish within-year between those who dropped out and those who are still enrolled but yet to complete. In practice, right censoring affects enrolments in both Victoria and the rest of Australia and, if anything, the post-treatment growth in second semester enrolments in Victoria would tend to negatively bias any estimated completion effect in Victoria using this measure.

The second completion measure is module (or *subject*) completion, which for a given course enrolment is the proportion of module enrolments that a student passes from the time of enrolment to the end of the following year. This is designed to reduce the right censoring problems discussed above, given that most students enrol in multiple modules in a semester typically lasting less than six months. This variable also helps to address the argument that some students enrol in a course only to learn a set of skills linked to a specific subset of modules, for example, to meet current job needs (see Mark and Karmel, 2010). Further details on enrolments, variable definitions and estimated course wage premia are contained in the Supplementary Appendix.

5. Identification and estimation

In common with many previous school choice studies, differences across space are exploited to identify impacts. In particular, differences in the timing of national reform implementation between Victoria and the rest of Australia, which occurred for exogenous political reasons, are exploited here using a standard difference-in-differences approach (see Blundell and Costa Dias, 2009). Specifically, linear regressions of the following form are estimated:

$$y_{ist} = \tau_s + \lambda_t + \delta(Vic_i . Post_t) + \beta X_{it} + \varepsilon_{ist} \quad (1)$$

where,

τ_s are state fixed effects;

λ_t are year and month of enrolment fixed effects;

δ is the average treatment effect on the treated (ATT);

Vic_i is a dummy variable for whether individual *i's* enrolment was in the state of Victoria;

$Post_t$ is a dummy variable for whether the enrolment is in the post-reform period;

X_{it} contains individual characteristics, including personal, college and course choice characteristics;

ε_{ist} is a stochastic error term.

As observed in Table 1, the post-reform enrolment growth was ongoing, which suggests other treatment effects may vary over the post-reform period. To test this, a dynamic treatment effects model is also estimated by extending equation (1):

$$y_{ist} = \tau_s + \lambda_t + \sum_{p=2010}^{2012} \delta_p (Vic_i . p) + \beta X_{it} + \varepsilon_{ist} \quad (2)$$

where p is a series of year dummy indicators for each of the post-reform periods.

A feature of our approach is the estimation of treatment effects under a range of assumptions regarding counterfactual outcomes. Under the standard difference-in-difference approach (implicit in equations 1 and 2), outcomes in the treatment group (Victoria) are assumed to follow a path that is parallel to that of the control group (Rest of Australia) in the absence of the reform. This is a restrictive and untestable assumption. In this study, we test the robustness of our results to alternative counterfactual trend assumptions. Specifically, in the main text we follow Jayachandran et al., (2010) and Groen and Polivka (2008) by also estimating (1) under a linear diverging trend assumption. That is, in the absence of the reform, the treatment group outcomes are assumed to linearly diverge from the control group trajectory at a rate that is consistent with any divergence pre-reform (2006-09).[15] This is implemented (in equation 1) by including linear state-specific trend terms.[16] In the sensitivity analysis, we also estimate results under non-linear diverging trend assumptions. Where there are no diverging trends pre-reform, results under both assumptions will be identical.

5.1 Potential Threats to Identification of Causal Impacts

Identification of causal impacts are contingent upon there being no other shock that differentially affected treatment and control groups over the period of analysis. There were no other major state-specific VET reforms over this period, and all states but one continued to operate the same funding models that had existed at the time of the national agreement on VET reform in 2008 without any subsequent reforms. The partial exception is South Australia, which introduced its own voucher scheme in July 2012. Sensitivity analysis tests the robustness of the results to the reforms in South Australia by omitting the second half of 2012 from the analysis. One possible threat to identification, however, is the introduction of an Australia-wide requirement in 2010 for all youth to remain in study until age 17, which may have affected Victoria differently because its minimum school leaving age was higher, at 16, than in many other states. To test whether this affects the results, models are re-estimated without those who

enrol at age 17 or younger. Results are presented in section 8. Another potential threat is differential economic shocks from the global financial crisis. However, it is important to stress that Australia was relatively unaffected by this crisis, with continued, albeit slower economic growth in 2008 and 2009. Nonetheless, controls for annual unemployment rates at the local government area are included in an effort to control for any asymmetric shocks from this source. A further test for differential state-level economic shocks is conducted by limiting the sample to enrolments in two neighbouring towns either side of the Victoria-New South Wales (NSW) border, for which such shocks are less likely. Results are presented in section 8.

Although anticipation effects between announcement (August 2008) and implementation (July 2009) seem unlikely on the supply side, they seem at least possible on the demand side. For example, some Victorian 15-19 year olds may have waited for the VTG to access their course of choice rather than enrol in another publicly-funded or fee-for-service course. This could impact both course choice and completion. But as discussed above there is little evidence for such an effect. If anything, enrolments in Victoria slightly increased in the first half of 2009. Nevertheless, the robustness of estimates to announcement effects is addressed further in section 8 where results are estimated with the omission of enrolments from August 2008 until December 2009.

A necessary condition to estimate the impacts of the VTG for a student body with given characteristics, i.e. the ATT, is that there are no relevant, asymmetric, unobserved changes in the composition of students. This is not directly testable, but the stability of observable characteristics between the pre and post-reform periods offers some reassurance (see Table 2). One potential threat here is cross-border VET commuting into Victoria induced by the VTG. In practice, however, this is not a major concern because, with the exception of the towns of Albury and Wodonga that straddle the Victoria-NSW border, few people live anywhere near the Victorian border. Table 2 shows that less than 3 percent of people studying in Victoria have

an interstate residential address, and this proportion is lower in the post-reform period. Nevertheless a control for this is included.

All standard errors are cluster-robust, with clustering at the state and territory level (group size of 8 or G=8). Because the group size is small, a conservative approach is adopted and significance levels are reported using critical values from the T(G-1) distribution, as suggested by Cameron et al. (2008) and Cameron and Miller (2015). The conservative approach is warranted because of potential downward bias of the cluster-robust error estimates when the group size is small. Results based on wild cluster bootstrapping, a method also suggested by Cameron and Miller (2015), are presented in section 8.

6. Estimated impacts on course choice

While the popular media fixated on post-VTG enrolment increases in fitness instructor and other 'soft' courses with questionable career prospects,[17] in reality there were enrolment increases across the board. There were indeed large increases in the number of students training to be fitness trainers, but there were also large enrolment increases in courses that prepare students for work in skill shortage occupations, such as child care workers, child care centre managers, electricians, plumbers, hairdressers and cooks (see Supplementary Appendix).

Table 3 presents estimates for constant and time-varying treatment effects (equation 1 and 2), including results under alternative counterfactual trend assumptions in the constant treatment effects case. The first two columns of estimates are not conditioned on observables and represent the overall effects of the reforms. The first column of estimates suggests that the VTG led to economically and statistically significant increases in the proportion of enrolments in courses related to skill shortage occupations of between 2.5 and 5 percentage points. The time-varying treatment effect estimates – which do not include state-specific trends – suggest the magnitude of this effect was reasonably stable over the three post-treatment years. Results are also consistent regardless of the counterfactual assumptions.

The second column of estimates for expected graduate earnings are generally positive over the post-reform period, although the overall magnitude and significance of the effect is sensitive to the choice of counterfactual trend assumption. Under standard parallel trend assumptions, we find initially positive impacts that become negative by year 3, with no positive effect overall. In contrast, under alternative counterfactual assumptions of linear diverging trends, we find significant positive results. Given the sensitivity of the results to counterfactual trend assumptions, we cannot be sure that the reform led to enrolments with higher expected graduate earnings on average over the post-reform period. There is also a plausible reason why the reforms may not have increased expected graduate earnings. Specifically, it is possible that increased responsiveness of enrolments associated with skill shortages in 2010 and 2011 – a shift right in labour supply – led to lower graduate earnings in these areas and students did not update their choices accordingly. This explanation is supported by analysis presented in the Supplementary Appendix that shows that the VTG was associated with an 8 percent fall in graduate earnings within skill shortage areas in 2011 (Table A6) and that the composition of student enrolments didn't adjust accordingly (Table A7).[18] Unlike for skill shortages, information on graduate earnings is not made publicly available.

Adding controls for student and provider characteristics to the model – the second and third sets of results in Table 3 – makes little difference to the estimated treatment effects under either counterfactual trend assumption. Because it is a rich set of observable student characteristics being controlled for here, with no discernible effect on the estimates, it is implausible that compositional changes in unobservables are instead driving the estimated effects. If the overall VTG impact on course choice is not being driven by compositional changes on the demand or the supply side, then we are left with differences in information accessed by students and government, differences in the weight placed on the consumptive benefits of education, and government inertia and political economy factors as potential mechanisms. If we assume that

government is better informed regarding skill shortages at the national level and places a lower weight on the consumption benefits of education than 15-19 year old potential students, then government inertia and political economy factors are left as the most likely mechanisms to explain this *positive* impact of the VTG reforms on the course choice measures.

Now turn to the question of heterogeneous treatment effects. A key motivation for estimating such effects is a concern that students from disadvantaged groups may suffer (or at least benefit less than more advantaged students) from the introduction of a voucher scheme, possibly because of difficulty accessing and utilising labour market information. In fact, with a full set of controls, groups who are commonly regarded as disadvantaged do show increases in the proportion of enrolments in skill shortage areas, albeit the results are not always statistically significant. There are no groups for whom we find a significant negative impact under either counterfactual trend assumption or for either course choice measure, and none of the estimated effects for these groups are systematically larger or smaller than the baseline estimates (Table 4).

Table 4 does tentatively suggest discrepancies in course choice effects by college type, although conclusions in this respect are sensitive to the choice of counterfactual trend assumptions. These discrepancies – or more precisely the lack of discrepancies in the *opposite* direction – provide further evidence that the VTG did not primarily impact course choice through changes in the composition of the supply side; if anything, such compositional changes attenuated the overall VTG impact. For public colleges, the VTG drives an increase in the proportion of enrolments in skill shortage courses and an increase in expected course returns under both counterfactual assumptions whereas for private providers the picture is more mixed. Inasmuch as these estimates do show different course choice effects by college type, they are consistent with established public colleges exploiting their competitive advantages in delivering training in areas of persistent skills shortage, established over time under the

centrally-planned system, with private providers primarily exploiting new opportunities to capture public funding in other fields of student demand less closely linked to skill shortage areas.

7. Estimated impacts on achievement

Table 5 presents estimates for constant and time-varying treatment effects (equation 1 and 2), again including results estimated under alternative counterfactual trend assumptions in the constant treatment effects case. For both achievement measures, all estimated constant treatment effects are positive, regardless of the counterfactual trend assumption, although they are not always statistically significant. For reasons discussed earlier, however, the following discussion focuses on module completion, for which the estimates are highly robust to the choice of counterfactual trend assumption and consistently statistically significant.

The first set of estimates for module completion are unconditional and suggest that, under standard assumptions set out in Section 5, the VTG led to significant increases in completion rates in Victoria relative to the rest of Australia. The second set of estimates is conditional on student observables. As for course choice, adding individual controls makes little difference to the estimates, suggesting that observable compositional changes on the student side are unimportant in explaining impacts on academic performance. Again, it appears implausible that compositional changes in unobservables are instead driving the estimated effects. Adding provider characteristics as controls also has little impact on the estimated treatment effects (a slight fall in the magnitude of the estimated effect, but within conventional confidence intervals in each case). The final set of results adds controls for 71 fields of study categories, five course level categories and skill demand variables (national shortage and expected earnings at the time of enrolment) to (1). These also make little difference to the estimates.

In line with the school vouchers literature, after controlling for student and college compositional changes and changes in course choices, the remaining effect is most plausibly

interpreted as being driven by improvements in the quality of VET provision associated with increased competition between providers. The magnitude of this module completion effect is also large; of roughly the same order of magnitude as the negative impact from having a disability at the time of enrolment.

Note there is a marked delay in the onset of this positive completion effect – it is only really in the second post-reform year that the competition effect kicks in – which is consistent with administrative barriers or other sources of institutional inertia holding back change in response to the new environment on the part of incumbent providers. For example, it may take time to replace under-performing teaching staff or management.

Now consider heterogeneous effects. A concern in the school voucher literature is that any improvement in efficiency from the introduction of an untargeted voucher comes at the expense of equity because of rent-seeking responses by colleges (e.g. Levin, 1991; Ladd, 2002). Table 6 presents the estimated VTG effects for key groups and college types under both sets of counterfactual trend assumptions and with the full set of controls. As for the average estimates the focus is on the module completion results. While results in Table 5 suggest that the VTG leads to improved efficiency, measured by improvements in module achievement, results presented in Table 6 suggest no clear trade-off with equity. Significant improvements in module completion rates are observed for all of the identified groups commonly regarded as disadvantaged, and again none of the estimated effects for these groups are systematically larger or smaller than the baseline estimates.

The absence of an equity-efficiency trade-off associated with the VTG contrasts with findings in the school vouchers literature (see Epple et al., 2015). This could reflect general institutional differences between sectors: unlike school, VET colleges are open access, cater particularly for people who are not academic high fliers, and enrolment is voluntary. But there are other possible explanations specific to the design of the VET voucher, including tight

constraints on fee increases and cream-skimming, which may have allowed the Victorian government to reap achievement-related benefits from greater competition without widespread equity-related costs.

The VTG also drives improvement in private provider and public college module completion rates, although the positive effect for public colleges is only marginally significant in one case. A positive effect among existing colleges suggests they are upping their game in response to the reforms. The parallel in the schools competition literature is the positive impacts on achievement in existing public schools – lifting all boats – reported by Hoxby (1994; 2000; 2003).

8. Sensitivity analyses

This section discusses sensitivity analyses that together help to reinforce the main conclusions from the preceding sections (see Table 7). Unless otherwise stated, all sensitivity results are estimated under standard trend assumptions using the full set of controls, consistent with results presented in the right-hand columns of Tables 3 and 5.[19] That said, we test the sensitivity of results to other alternative counterfactual trend assumptions besides linear diverging trends, namely *non-linear* (quadratic). Results from these tests produce consistently positive and significant results across all measures, with 90% confidence intervals that are, in the main, overlapping with those from the standard results with full controls (from Tables 3 and 5).

Although there are few obvious culprits (and each is addressed below), the possibility of other uncontrolled-for asymmetric shocks at the state level cannot be entirely ruled out ex ante for any of the four outcome measures. This is less likely to be an issue, however, for the twin towns of Albury and Wodonga, situated on opposite banks of the Murray River on the NSW-Victoria border, and which share a common labour market. Both towns have populations of around 50,000 people and both have their own public and private VET colleges, but only

colleges in Wodonga on the Victorian side were directly affected by the VTG. Using a similar difference-in-differences approach to estimate (1) for colleges operating in the local government areas of Albury-Wodonga again shows positive and statistically significant VTG impacts on all outcome measures, although the estimated magnitudes of these impacts differ (based on non-overlapping confidence intervals) from those estimated at the full state level. The relatively large impact on enrolments in skill-shortage areas may reflect the inability of the former centralised funding model to respond to the specific needs of local labour markets.[20]

One possible candidate for an asymmetric state-level shock is the introduction of national requirements to be in study (school or VET) until age 17 in 2010, which may have had differing effects in the rest of Australia and Victoria because prior compulsory education ages were different across states. Most importantly, compulsory education leaving age in NSW, the most populous state, was 15 prior to the reform, compared to 16 in Victoria. Results in Table 7 show that restricting the sample to those who enrolled at 18 and 19, and who were therefore unaffected by the national education requirement, increases the magnitude of the positive effects. The reason for the stronger results without those aged 17 or under is that the introduction of the national education requirement reduced the number of 15 and 16 year-olds in VET in the rest of Australia relative to Victoria from 2010. Because young people who leave school at this age tend to make relatively poor course choices and perform relatively poorly, the reform tended to improve outcomes in the rest of Australia relative to Victoria, biasing the estimated effects of the VTG downwards. These suggest that our results are conservative.

Other specific sources of potential asymmetric shocks are anticipation effects that may have occurred in Victoria post-announcement but pre-reform; post-reform effects that occurred in the second half of 2009; and the introduction of the South Australian voucher in July 2012. Responses that may have occurred prior to the commencement of the post-reform period are examined by re-estimating all models without enrolments from the time of announcement

(August 2008) to the end of 2009. This restriction does not impact on the estimated magnitude of the VTG impacts, but does reduce precision. Asymmetric shocks to the rest of Australia from the introduction of the South Australian voucher are examined by re-estimating without enrolments from July 2012. Results are much the same as without their exclusion.

To examine whether college and course controls are adequate to deal with compositional changes associated with the VTG, the models for course choice are re-estimated with college fixed effects, and the models for achievement are re-estimated with college and course fixed effects. This makes little difference to the estimated VTG impacts, although adding college fixed effects does increase the magnitude of course choice outcomes to the point that the positive estimated effect for expected returns is on the cusp of statistical significance at 10%. This is likely to reflect disproportionate growth in the private colleges that specialise in courses that are unrelated to skill shortages. Conclusions remain unchanged.

The sensitivity of the results to decisions regarding the sample is also tested. First, note that fee-for-service enrolments with public colleges that are not covered by the VTG, but which may be displaced by the VTG, are included in the analysis thus far. Results estimated with such enrolments excluded are reported in Table 7. Second, when estimating outcomes using the skill shortage measure, enrolments that are not associated with a specific occupation are omitted. The estimates are therefore for a smaller sample than those for the earnings-based measure. To test the effect of differences in the sample, the model for expected earnings is re-estimated on the same sample used for skill shortages. Third, for the field of study/course level combinations for which insufficient observations in the SOS are observed to confidently estimate an average wage premium, estimates are generated from more aggregated field of study/course level combinations. Alternatively enrolments in these courses can be dropped from the estimation of the wage-based measure of course choice. Results from using each of these alternative samples are much the same as the standard results reported in Tables 3 and 5.

Finally, in the models estimated thus far, inference has been based on cluster-robust standard errors using conservative T(G-1) critical values (Cameron et al., 2008 and Cameron and Miller, 2015). Despite the conservative approach, however, it is still possible to over-reject the null hypotheses of no significant effects (Cameron and Miller, 2015). Robustness is tested following Cameron and Miller's (2015) suggestion by re-estimating the significance levels of the main results (with full controls) using wild cluster bootstrapping with 1000 iterations. This method has been shown to perform well in simulation studies, including when the group size is less than 10 (Cameron et al., 2008). The p-values estimated from the bootstrapping are all significant at the 10% mark and suggest that inference based on cluster-robust standard errors and T(G-1) critical values is not leading to over-rejection of the null in this case.

9. Conclusions

This paper exploits a unique natural experiment in Australia to demonstrate for the first time that introducing a system-wide voucher scheme can improve the relevance and quality of post-secondary VET. Further, by varying controls, conclusions are drawn regarding possible causal mechanisms. The key question that remains is the extent to which these conclusions might generalise to VET elsewhere and to other parts of the education sector.

For course choice, the positive treatment effect shows that linking funding to student choices, rather than centralised government allocations, led to a better alignment of enrolments with skill demands, as defined by enrolments that prepare students for jobs on national skill shortage lists. For employers, the improved enrolment responsiveness to skill shortages reduced the cost of employing new graduates in these occupations. However, the extent to which students responded to changes in course graduate earnings, an alternative signal of skill demand, is unclear because the significance and magnitude of the results depend on the underlying counterfactual trend assumption. The weaker student response to the latest course graduate earnings compared to the latest skill shortages, regardless of the trend assumption, is

not surprising given that information on the former is not publicly available. This result underlines the need for the public release of up-to-date information on course-specific returns to complement government skill shortage information.

Whilst there is no guarantee that the same positive course choice impacts would be replicated elsewhere – these may have been unusually well-informed students, or the Victorian government at the time may have made unusually poor allocation decisions pre-reform – the fact that other Australian states and other English-speaking countries with shared VET-sector characteristics also share dissatisfaction with existing funding models on the grounds of training *relevance* suggests Victoria is not uniquely able to benefit from a broad-based VET voucher, particularly where students are also given access to relevant information on course-specific returns.

The paper also shows that membership of a disadvantaged group does not affect one's ability to benefit from greater agency to select preferred post-secondary courses afforded under a voucher. This contrasts with literature that suggests students from disadvantaged groups benefit less from school choice reforms because of an inability to access and assess school performance information (Levin, 1991; Ladd, 2002; Hastings and Weinstein, 2008). One explanation is that when choosing post-secondary VET courses, students from disadvantaged groups may be less encumbered by resource constraints and parental attitudes, and may link course choice more closely to their future job prospects than when choosing schools. It may also be that labour market information is more equally available (or *unavailable*) than information on school quality. The extent to which this particular conclusion might generalise beyond Australian VET is unclear, but we at least have new evidence that leads us to question the extent to which the *earlier* conclusions regarding the equity costs of school choice reforms generalise to other educational contexts.

For achievement, increased competition between providers is the channel most consistent with the estimated positive reform impacts, which are observed across both new private providers and incumbent public providers; competition raises all VET boats. A further contribution of the paper is to demonstrate that these achievement gains, like the course choice gains, do not come at a cost to equity; in contrast to findings by Hsieh and Urquiola (2006) and others, this paper shows that under conditions where there is little student selection, academic achievement gains are widespread, including among disadvantaged groups. To the extent that this reflects potentially replicable regulations that constrain cream-skimming and fee caps, then the findings highlight the potential role of such safeguards in realising the competition benefits of broad-based vouchers without the equity costs.

There are of course many caveats to bear in mind when drawing these conclusions. It is possible that students make better course choices according to the two measures here, but would not do so according to some alternative measure forecasting ahead to future labour market needs, where governments plausibly have a greater informational advantage. It is also possible that the improvements in student achievement reflect a form of grade inflation (or more precisely *competency* inflation) rather than any real improvement in skills, given that across Australia (and in other countries) it is the colleges themselves that are responsible for assessment. (This would in itself be an interesting result, but not necessarily one that governments would want to replicate). If nothing else, however, the regime in place for external moderation of assessments, coupled with the fact that course-level completion data were not made systematically available at the time, make us question this as an explanation. Third, the conclusions are based on just three post-reform cohorts, each followed for a maximum of two years, and there is reason to suspect – from the estimates presented here and from the wider literature – that the early impacts of such reforms may differ from longer run impacts.

The narrative around these reforms turned rapidly negative in Victoria in the absence of credible evidence on their impacts at the time and given the budgetary implications of the rapid growth in enrolment. This led to the partial roll-back of the reforms in July 2012, which this paper shows may have been a mistake. Looking forward, this paper can potentially support governments to design, implement and sustain wholesale changes, perhaps against the wishes of incumbent providers and in the face of hostile media coverage.

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Table 1: New post-secondary VET course enrolments of 15-19 year olds

	Victoria			Rest of Australia		
	Public college	Private college	Total	Public college	Private college	Total
2006	52,861	9,454	62,315	130,722	22,267	152,989
2007	53,218	8,304	61,522	133,225	21,752	154,977
2008	53,774	6,811	60,585	118,351	23,650	142,001
2009	54,773	7,406	62,179	130,233	30,485	160,718
2010	60,711	16,766	77,477	127,716	36,233	163,949
2011	58,667	30,632	89,299	126,736	39,266	166,002
2012	82,411	33,604	116,015	129,976	35,191	165,167
Avg. annual 2006-09	53,657	7,994	61,650	128,133	24,539	152,671
Avg. annual 2010-12	67,263	27,001	94,264	128,143	36,897	165,039
Difference	13,607	19,007	32,613	10	12,358	12,368

Note: Public colleges include Technical and Further Education (TAFE) colleges, Adult and Community Education (ACE) colleges and Universities. Private colleges include professional/industry organisations, other non-government organisations and for-profit training colleges. These estimates exclude enrolments among those who are still in secondary school.

Table 2: Mean characteristics of 15-19 year-old new post-secondary VET course enrolments, pre and post reform

	Victoria		Rest of Australia	
	2006-09	2010-12	2006-09	2010-12
Outcomes				
National Skill Shortage enrolments (%)	18.3	13.0	22.8	15.1
Expected graduate earnings (log earnings, $A2013)[a]	-0.13	-0.11	-0.11	-0.09
Course completion (%)	23.2	29.5	28.8	31.5
Module completion (%)	73.3	78.3	76.3	76.6
Controls				
State (%)				
Victoria	100	100		
NSW	-	-	41.1	39.2
Queensland	-	-	26.2	27.3
Western Australia	-	-	15.2	16.3
South Australia	-	-	9.8	10.6
Tasmania	-	-	4.2	3.9
Australian Capital Territory	-	-	2.1	1.5
Northern Territory	-	-	1.4	1.2
Year of course commencement (%)				
2006	25.3	0	25.1	0
2007	24.9	0	25.4	0
2008	24.6	0	23.3	0
2009	25.2	0	26.3	0
2010	0	27.4	0	33.1
2011	0	31.6	0	33.5
2012	0	41	0	33.4
Month of course commencement (%)				
January	25.6	10.8	10.5	8.6
February	37.4	33.3	42.7	37.6
March	4	7.3	6.1	7
April	3.6	5.8	4.1	4.5
May	3.2	5.9	4	4.9
June	2.7	7.2	3.1	3.6
July	13.9	11.3	17.9	19.7
August	3	5.3	3.7	4.8
September	1.9	4	2.6	2.9
October	2.6	4.3	2.6	3.2
November	1.4	3.5	1.9	2.3
December	0.7	1.3	0.8	0.9
Interstate residential address (%)[b]	2.7	2	1.7	1.8

Residential unemployment rate (local government area %)[c]	5.0	5.5	4.8	5.6
Student characteristics[d]				
Student is female (%)	43.6	43.8	44.3	42.7
Age in years on January 1 in the year of enrolment (%)				
15	7.3	4.9	8.1	7.4
16	12.4	10.5	15.1	14.4
17	20.8	20.2	26.2	26.3
18	35	36.5	29.1	29.4
19	24.5	27.9	21.6	22.6
Aboriginal or Torres Strait Islander (%)	6	3.6	15.7	16.3
Migrant status and language spoken at home				
Doesn't speaks a language other than English at home, Australian born	50.4	59.2	56.3	67.5
Speaks a language other than English at home, Australian born	2.3	3.3	3.1	4.2
Doesn't speak a language other than English at home, foreign born	32.8	28.2	26.5	17.2
Speaks a language other than English at home, foreign born	9.5	8.2	6.9	5
Regional classification of residence (%)				
Major city	68.7	72.7	64.7	63.4
Inner regional	25.8	22.5	20.8	21.6
Outer regional	5.4	4.7	11.3	11.9
Remote	0.1	0.1	2.1	2
Very remote	0	0	1.1	1.1
Employed at time of enrolment (%)	58.1	56.2	58.5	52.1
Has a disability (%)	6.6	7.6	5.6	6.9
Socio-economic status of residential area (%)				
1st quintile (most disadvantaged nationally)	4.3	4.2	11.5	11.9
2nd quintile	14	12.5	12.5	13
3rd quintile	18	16.9	18.4	19.1
4th quintile	31.2	34.6	27.6	27.8
5th quintile (most advantaged nationally)	32.5	31.7	30	28.2
Highest prior level of education completed (%)				
Tertiary education (ISCED 4B and above)	0.4	0.7	0.6	0.8
Secondary school (ISCED 3A) or vocational equiv. (ISCED 3C)	51.3	53.5	46.2	44.3
Less than secondary qualification	48.3	45.8	53.2	54.9
College characteristics[d]				
Number of enrolments in 2008 (%)				
Provider didn't exist	0.6	12.9	4.2	11.3
<100 enrolments	9.1	12.7	7.3	7.9
100-999 enrolments	10.7	10.8	12.4	13.4
1000-3999 enrolments	31.7	24.9	22.2	21.5

4000-6999 enrolments	39.9	32.5	31.2	27.7
7000+ enrolments	8	6.2	22.5	18.2
Type of college (%)				
Public Technical and Further Education (TAFE)	71.7	57.4	80.5	74.5
Public Adult Centre for Education (ACE)	7.4	7.7	3.3	3.1
Public University	8	6.2	0.1	0.1
Private industry, professional association or non-government organisation	5.5	6	3.7	3.6
Private for profit	6.6	22.1	9.9	13.6
Private other	0.9	0.5	2.5	5.1
Course characteristics[d]				
Course qualification level (%)				
Certificate of attainment	0.2	1.8	0.3	1.9
Certificate I	8.3	11.4	8	7.9
Certificate II	26.4	24.7	22.4	25.9
Certificate III	35.3	37.8	46.7	44.2
Certificate IV	12	12	11.7	11.5
Diploma+	17.8	12.4	11	8.5
Field of study (ASCED 2-digit, %)[e]				
Natural and physical science	0.5	0.3	0.4	0.4
Information technology	3.4	1.8	3.9	3.4
Engineering and related technology	17	14.2	20.2	19.3
Architecture and building	9.7	10.1	8.9	10.5
Agriculture, environment and related	3.6	2.7	3.8	4
Health	2.8	3.1	2.4	3.1
Education	0.2	0.2	0.7	0.6
Management and commerce	25.3	22.2	23.7	20.9
Society and culture	8.5	11.4	9.7	10.7
Creative arts	4.3	4	4.5	4.8
Food, hospitality and personal services	15.1	14.3	14.1	12.7
Mixed programs/general courses[f]	9.6	15.7	7.7	9.6
National skill shortage[g]	16.5	10.8	21.1	13.4
Expected graduate earnings (log earnings, $A2013)[h]	-0.13	-0.11	-0.11	-0.09
Count	246,601	282,791	610,685	495,118

Estimates are based on the full set of information available for each variable. None of the variables have more than 5% missing. These estimates exclude enrolments among those who are still in secondary school. This data includes information on multiple enrolments by the same individuals within a given year.

[a] This is relative to estimated earnings from graduates in certificate III Building,, a qualification undertaken as part of a building apprenticeship. [b]Identified as people whose state of residential address is different to their state in which they enrolled in study. [c]Local government area is the geographic boundary of municipal governments similar to a county. The data is published by the Australian Department of Employment. [d]For more information on the definition of these variables, see Table A1 of supplementary appendix. [e]Information on field of study is presented in this table at a more aggregate level (2-digit Australian Standard Classification of Education (ASCED)) than is used in the analysis (4-digit ASCED) to save space. [f]General courses are ones that are not preparation for a specific occupation, such as numeracy and literacy courses and employment skills training. [g]Binary indicator for whether course of enrolment is associated with preparation for work in an occupation that is on the national skill shortage list at the start of the year of enrolment. When used as a control in course completion models, mixed field and general courses that do not prepare students for a particular course are coded 0. [h]Only used as a control in course completion models.

Table 3: Difference-in-differences coefficient estimates for course choice, 2010-12

	Unconditional		With individual controls		With individual and provider controls	
	National skill shortage	Expected graduate earnings	National skill shortage	Expected graduate earnings	National skill shortage	Expected graduate earnings
Standard counterfactual assumptions[a]						
Constant treatment effect (2010-12)	0.025***	0.003	0.023***	0.006	0.021**	0.004
	(0.006)	(0.006)	(0.003)	(0.005)	(0.007)	(0.006)
Time-varying treatment effect						
2010	0.030***	0.017**	0.025***	0.018**	0.023**	0.017**
	(0.006)	(0.007)	(0.005)	(0.007)	(0.007)	(0.007)
2011	0.020**	0.022*	0.022***	0.027**	0.021**	0.024*
	(0.007)	(0.010)	(0.005)	(0.010)	(0.009)	(0.011)
2012	0.025**	-0.024***	0.022**	-0.021***	0.020**	-0.023***
	(0.008)	(0.005)	(0.007)	(0.005)	(0.008)	(0.006)
Alternative counterfactual assumptions[b]						
Constant treatment effect (2010-12)	0.050**	0.033***	0.044**	0.035***	0.047***	0.033***
	(0.015)	(0.009)	(0.014)	(0.008)	(0.013)	(0.008)
Count	1,462,223	1,596,394	1,457,328	1,591,001	1,456,904	1,590,552

***Significant at 1%, **significant at 5% and *significant at 10%. Standard errors are robust-clustered at the state and territory level with critical values based on T(8-1) distribution. All models are estimated using all available information. The sample size for results using the National Skill Shortage measure are smaller because we exclude enrolments in general courses that do not prepare people for any specific course.

[a]Counterfactual outcomes in Victoria are assumed to follow a parallel path to those of the Rest of Australia. [b]Counterfactual outcomes in Victoria are assumed to diverge relative to the Rest of Australia at the same constant rate present prior to the reform (2006-09).

Table 4: Heterogeneous difference-in-differences coefficient estimates for course choice, 2010-12, constant treatment effects with individual and course controls

Sub-sample	Standard counterfactual assumptions[a]		Alternative counterfactual assumptions[b]	
	Skill shortage	Expected graduate earnings	Skill shortage	Expected graduate earnings
Female	0.003	0.006	0.026**	0.034**
	(0.007)	(0.006)	(0.011)	(0.010)
Disability	0.025*	0.026**	0.036***	0.045**
	(0.012)	(0.011)	(0.008)	(0.014)
Speaks a language other than English at home	0.039**	0.009	0.040**	0.039**
	(0.015)	(0.008)	(0.016)	(0.012)
Reside in a suburb whose socio-economic status (SEIFA) is in the lowest quintile nationally	0.038*	-0.008	0.026	-0.000
	(0.016)	(0.013)	(0.024)	(0.014)
Lives outside a capital city	0.017*	-0.005	0.033*	0.019
	(0.008)	(0.006)	(0.015)	(0.013)
Less than secondary school qualification	0.008	-0.006	0.033**	0.033***
	(0.009)	(0.008)	(0.012)	(0.009)
Unemployed	0.025***	-0.000	0.049***	0.043***
	(0.004)	(0.009)	(0.007)	(0.010)
Public college	0.044***	0.015	0.048***	0.045***
	(0.006)	(0.008)	(0.008)	(0.009)
Private for profit college	-0.037	0.006	0.047	0.038***
	(0.051)	(0.005)	(0.103)	(0.007)
Overall	0.025***	0.003	0.047***	0.033***
	(0.006)	(0.006)	(0.013)	(0.008)

***Significant at 1%, **significant at 5% and *significant at 10%. Standard errors are robust-clustered at the state and territory level with critical values based on T(8-1) distribution. All models are estimated using all available information.

[a]Counterfactual outcomes in Victoria are assumed to follow a parallel path to those of the Rest of Australia. [b]Counterfactual outcomes in Victoria are assumed to diverge relative to the Rest of Australia at the same constant rate present prior to the reform (2006-09).

Table 5: Difference-in-differences coefficient estimates for course completion, 2010-2012

	Unconditional		With individual controls		With individual and provider controls		With individual, provider and course controls	
	Module completion	Course completion	Module completion	Course completion	Module completion	Course completion	Module completion	Course completion
Standard counterfactual assumptions[a]								
Constant treatment effect (2010-12)	0.034***	0.038*	0.031**	0.029	0.022**	0.01	0.031***	0.011
	(0.009)	(0.019)	(0.011)	(0.020)	(0.009)	(0.017)	(0.008)	(0.011)
Time-varying treatment effect								
2010	0.020*	0.017	0.014	0.011	0.011	0.002	0.011	0.000
	(0.009)	(0.020)	(0.010)	(0.021)	(0.008)	(0.017)	(0.008)	(0.014)
2011	0.036***	0.050*	0.036**	0.039	0.022*	0.009	0.035***	0.008
	(0.010)	(0.023)	(0.013)	(0.024)	(0.010)	(0.021)	(0.009)	(0.016)
2012	0.043***	0.044**	0.040***	0.035*	0.031**	0.016	0.042***	0.025**
	(0.010)	(0.016)	(0.011)	(0.017)	(0.009)	(0.014)	(0.009)	(0.009)
Alternative counterfactual assumptions[b]								
Constant treatment effect (2010-12)	0.039***	0.067***	0.031***	0.061***	0.021**	0.040***	0.026***	0.041***
	(0.005)	(0.012)	(0.005)	(0.010)	(0.008)	(0.011)	(0.007)	(0.010)
Count	1,596,937	1,635,195	1,591,528	1,629,707	1,591,080	1,629,237	1,591,080	1,629,237

***Significant at 1%, **significant at 5% and *significant at 10%. Standard errors are robust-clustered at the state and territory level with critical values based on T(8-1) distribution. All models are estimated using all available information. The sample size for results using the National Skill Shortage measure are smaller because we exclude enrolments in general courses that do not prepare people for any specific course.

[a]Counterfactual outcomes in Victoria are assumed to follow a parallel path to those of the Rest of Australia. [b]Counterfactual outcomes in Victoria are assumed to diverge relative to the Rest of Australia at the same constant rate present prior to the reform (2006-09).

Table 6: Heterogeneous difference-in-differences coefficient estimates for course completion, 2010-2012, constant treatment effects with individual, provider and course controls

Sub-sample	Standard counterfactual assumptions[a]		Alternative counterfactual assumptions[b]	
	Module completion	Course completion	Module completion	Course completion
Female	0.016*	0.017	0.024***	0.056***
	(0.008)	(0.016)	(0.005)	(0.013)
Disability	0.002	0.008	0.028**	0.014
	(0.010)	(0.007)	(0.009)	(0.011)
Speaks a language other than English at home	0.028**	-0.011	0.042***	0.063***
	(0.011)	(0.012)	(0.007)	(0.010)
From lowest quintile of national SES measure (SEIFA)	0.030***	0.033*	0.049***	0.065**
	(0.008)	(0.016)	(0.006)	(0.022)
Lives outside a capital city	0.033***	-0.002	0.022**	0.003
	(0.005)	(0.009)	(0.009)	(0.007)
Less than secondary school qualification	0.027**	0.008	0.026**	0.031*
	(0.010)	(0.012)	(0.009)	(0.015)
Unemployed	0.009	-0.016	0.034**	0.016
	(0.011)	(0.012)	(0.012)	(0.011)
Public college	0.024**	-0.011	0.015	0.034***
	(0.009)	(0.014)	(0.010)	(0.007)
Private for profit business	0.035***	0.046**	0.075***	-0.013
	(0.007)	(0.018)	(0.017)	(0.051)
Overall	0.031***	0.011	0.026***	0.041***
	(0.008)	(0.011)	(0.007)	(0.010)

***Significant at 1%, **significant at 5% and *significant at 10%. Standard errors are robust-clustered at the state and territory level with critical values based on T(8-1) distribution. All models are estimated using all available information.

[a]Counterfactual outcomes in Victoria are assumed to follow a parallel path to those of the Rest of Australia. [b]Counterfactual outcomes in Victoria are assumed to diverge relative to the Rest of Australia at the same constant rate present prior to the reform (2006-09).

Table 7: Results for the sensitivity analysis, 2010-2012, under standard counterfactual trend assumptions[a] and constant treatment effects with full set of controls

	Course choice		Course completion	
	National skill shortage	Expected graduate earnings	Module completion	Course completion
Standard estimates (Tables 3 and 5)	0.021**	0.004	0.031***	0.011
s.e.	(0.007)	(0.006)	(0.008)	(0.011)
CI lower 90%	0.009	-0.007	0.015	-0.010
CI upper 90%	0.034	0.016	0.046	0.033
Parallel quadratic growth assumptions	0.043**	0.042***	0.017**	0.025*
s.e.	(0.014)	(0.008)	(0.005)	(0.011)
CI lower 90%	0.017	0.026	0.007	0.003
CI upper 90%	0.068	0.057	0.027	0.047
Enrolments restricted to Albury and Wodonga local government areas[b]	0.145***	0.046***	0.060***	0.107***
s.e.	(0.003)	(0.002)	(0.003)	(0.004)
CI lower 90%	0.138	0.042	0.053	0.100
CI upper 90%	0.152	0.050	0.067	0.115
Restrict to 18-19 year-olds	0.034**	0.010*	0.036***	0.024*
s.e.	(0.011)	(0.005)	(0.007)	(0.012)
CI lower 90%	0.014	0.000	0.022	0.001
CI upper 90%	0.054	0.020	0.049	0.047
Omit enrolments from August 2008 to December 2009	0.018**	0.005	0.025**	0.005
s.e.	(0.007)	(0.006)	(0.010)	(0.013)
CI lower 90%	0.004	-0.006	0.006	-0.020
CI upper 90%	0.032	0.016	0.045	0.029
Omit enrolments from July 2012	0.019**	0.008	0.029**	0.012
s.e.	(0.006)	(0.005)	(0.009)	(0.013)
CI lower 90%	0.007	-0.002	0.013	-0.013
CI upper 90%	0.031	0.018	0.046	0.037
Include college fixed effects	0.036***	0.012	-	-
s.e.	(0.003)	(0.007)	-	-
CI lower 90%	0.030	-0.001	-	-
CI upper 90%	0.042	0.025	-	-
Include college and provider fixed effects	-	-	0.020**	0.021
s.e.	-	-	(0.006)	(0.012)
CI lower 90%	-	-	0.009	-0.001
CI upper 90%	-	-	0.032	0.043
Excluding fee-for-service courses	0.017**	0.003	0.037***	0.016
s.e.	(0.007)	(0.007)	(0.009)	(0.011)
CI lower 90%	0.004	-0.01	0.021	-0.005
CI upper 90%	0.029	0.015	0.053	0.037
Excluding courses not linked to an occupation	-	-0.003	-	-
s.e.	-	-0.005	-	-
CI lower 90%	-	-0.011	-	-

CI upper 90%	-	0.006	-	-
Excluding expected wages with missing 4-digit cells	-	0.001	-	-
s.e.	-	(0.007)	-	-
CI lower 90%		-0.011		
CI upper 90%		0.014		
Wild bootstrapped standard errors	0.21***	0.004	0.031*	0.012
s.e.	(0.000)	(0.007)	(0.017)	(0.013)
CI lower 90%	0.021	-0.008	0.003	-0.01
CI upper 90%	0.021	0.016	0.059	0.033

***Significant at 1%, **significant at 5% and *significant at 10%. Unless otherwise stated, results are generated with a full set of student and college controls with state cluster-robust standard errors and critical values from T(8-1) distribution.

[a]Counterfactual outcomes in Victoria are assumed to follow a parallel path to those of the Rest of Australia.[b]Local government areas (LGAs) is an Australian standard geographical classification that covers the administrative boundaries of local governments, similar to counties in the United States. The LGAs of Albury (in Victoria) and Wodonga (in NSW) are divided by the Murray River, which is the Victoria and NSW state border. This model is estimated on a sample size of 1962 and 3073 observations for national skill shortage and course graduate wage respectively. Standard errors are robust-clustered at the state level with T(2-1) critical values. [c]We use the cgmwildboot program (provided by Judson Caskey, https://sites.google.com/site/judsoncaskey/data) to estimate p-values based on wild bootsrapped standard errors clustered at the state and territory level with 1000 draws. The program produces p-values (reported in square brackets) that are based on empirical T(8-1) distribution.

Endnotes

[1] Two recent examples of reforms are The *Skills for Sustainable Growth* reforms introduced in England in 2012/13 and the *Educating Tomorrow's Workforce Act 2015* in the US. The former aimed to provide greater contestability between VET colleges for public funding by granting 19-24 year-olds an entitlement to a government-funded place in training for basic level courses, which they could use to enrol in any course of their choosing. The latter attempted to make community college enrolments more responsive to local skill needs by linking annual federal funding allocations to measures of how closely course offerings are aligned to locally-identified skill needs.

[2] See OECD (2010) and OECD (2014) for ambitious attempts at such comparisons.

[3] Most media reports pointed to large increases in enrolment in specific courses in areas outside of skill shortage areas, such as health and fitness training, as evidence that the reforms were not working, but ignored growth in enrolments in areas that were in skill need, such as aged care and child care. Examples of these negative reports are: 'Market design fails to supply the skills', Australian Financial Review, 3 July 2012; 'Match training to needs: business', Australian Financial Review, 3 July 2012; 'Free market could limit skills: TAFE', The Australian, 12 January 2012.

[4] In 2008, Victoria was close to an election year (2010). Its centre-left government had been in office for almost ten years and its long-serving Premier resigned for personal reasons in July 2007. Faced with flagging political fortunes after a long term in office and slowing economic growth, the new Premier John Bracks took over with the intention of re-invigorating the party in the run-up to the 2010 election. Renewed commitment to education was a central focus and it was these political interests that were the key driver of Victoria's early adoption of the national reforms.

[5] The voucher schemes introduced in other states were much more limited than the VTG. Essentially, enrolments under the other state voucher schemes were limited to courses on government priority lists.

[6] In 2008, 27% of Victorians aged 15-19 in publicly-funded courses were undertaking apprenticeships or traineeships (National VET Provider Collection).

[7] In July 2012, the Victorian government partially unwound the 2009 reforms by making course subsidies more targeted towards perceived employer demand for graduates.

[8] In practice, direct tuition fees were regulated according to course level in each state, with a prescribed hourly rate and a minimum and maximum total annual fee. In Victoria, hourly fees for lower-level courses (certificates I and II, equivalent to ISCED2) were up to $1.51 per hour in 2011, with a minimum total fee of $187.50 and a

maximum total fee of $875. The highest fees were for Diploma level courses – up to $3.79 per hour, minimum total fee of $375 and a maximum total fee of $2000. Many students were also eligible for reduced fees, e.g. on the grounds of receiving Income Support (welfare).

[9] Relevant requirements for registration include to make reasonable adjustments to accommodate people with disability (under the Disability Discrimination Act 1992), and to adopt policies and approaches aimed at ensuring VET colleges respond to the individual needs of clients whose age, gender, cultural or ethnic background, disability, sexuality, language skills, literacy or numeracy level, unemployment, imprisonment or remote location may present a barrier to access, participation and the achievement of suitable outcomes.

[10] LSAY 2003 tracks the cohort of 15 year-old students who participated in the OECD Program for International Student Assessment (PISA) in 2003 (around 10,000 students) annually until age 25. Fee-for-service estimates in private colleges are estimated as the share of 17-19 year-old school leavers/graduates in 2005-07 who enrol in non-government colleges, excluding apprentices and trainees because they are all entitled to a publicly-funded place in training. This is likely to be an over-estimate because prior to reform private colleges were also able to tender for small-scale public training contracts, such as training programs for public sector employees.

[11] These occupations are at the Australian and New Zealand Standard Classification of Occupation (ANZSCO) 6-digit level. There are 998 ANZSCO 6-digit occupations in all. Skill shortage lists are compiled by the Department of Employment: https://www.employment.gov.au/skill-shortages.

[12] Grogger and Eide (1995) and Avery and Turner (2012), for example, do something similar to estimate returns to different college majors in the US. Where there are sparse cells, results estimated with course level and 2-digit field of study combinations are used. Field of study is 4-digit Australian Standard Classification of Education (ASCED).

[13] See http://www.ncver.edu.au/sos for further details on the SOS.

[14] Earnings data are reported in bands from which this analysis uses the midpoint.

[15] See supplementary material for tests of diverging pre-reform trends.

[16] Implemented by introducing state-specific trend terms coded -3, -2,…,2, 3 corresponding to the years 2006 to 2012 respectively.

[17] Match Training to Needs: Business. The Australian Financial Review (3/7/2012).

[18] The reduction in graduate earnings in 2011 is estimated using conditional difference-in-difference analysis using SOS graduate earnings data. The lack of response to the fall in 2011 earnings in skills shortage areas in 2012 is demonstrated by re-estimating unconditional difference-in-difference models under standard

counterfactual assumptions (equation 1) with expected graduate earnings fixed at 2010 levels for students enrolling in 2012. Under this scenario, the result in 2012 is much more positive and statistically significant (Table A7).

[19] We have also estimated the same sensitivity tests under alternative trend assumptions (diverging linear trends). Results from these tests produce the same conclusions, that is, results are not sensitive to alternative model specifications — treatment effects have the same sign and statistical significance as under the standard model specification (see Table A8 from the supplementary material).

[20] The Albury-Wodonga economy is not typical of Australian inland towns that usually rely heavily on agriculture. A legacy of decentralisation policies in the 1970s and its history as a transport hub, the Albury-Wodonga economy depends heavily on manufacturing and business services that require workers with trade, engineering and other technical training. However, twenty-five consecutive years of economic growth in Australia has led to skill shortages in many of skill areas and inland towns far from capital cities, such as Albury-Wodonga, have struggled to attract the required skilled workers (see Cameron 2011 for an overview of prevailing skill shortage problems in inland Australian towns). Albury-Wodonga is situated on the main highway joining the two largest capital cities in Australia, Sydney and Melbourne. It is 553km south of Sydney and 325km north of Melbourne. The towns were formed in the 1830s on opposite banks of the river to accommodate the transportation of goods between the two main Australian colonies and as customs houses to collect duties on goods travelling between the two colonies.

Course Choice and Achievement Effects of a System-wide Vocational Education and Training Voucher Scheme for Young People: Online Supplementary Material

Table A1 defines the control variables included in (1) in the main paper. Table A2 provides further descriptive information on the national skills shortage lists behind one of the course choice measures. Table A3 gives the estimated wage premia associated with different qualifications that lie behind the second course choice measure in the main paper. Table A4 provides estimates from tests for pre-reform diverging trends for all outcomes on the pre-reform sample. Table A5 shows courses that experience the largest average post-reform enrolment growth — those with more than 500 extra enrolments per annum. Table A6 presents the key results from analysis using the Student Outcome Survey that show the impact of the VTG on graduate wages in skill shortage areas. The results presented in Table A7 are from equation (2) in the main paper with course demand information associated with 2012 enrolments restricted to that faced by students enrolled in 2011. Tables A8 are results for the sensitivity tests presented in Table 7, except with linear time trends.

Table A1: Description of control variables

Variable	Description
Student characteristics	
Female	Dummy variable of gender
Age in years on January 1 in the year of enrolment	Dummy variable derived from the date of birth. To be eligible for the VTG, course applicants must provide evidence to verify their date of birth
Aboriginal or Torres Strait Islander	Self-identified as being from Aboriginal or Torres Strait Island decent
Migrant status and language spoken at home	Migrant status is self-reported country of birth, which is collapsed into whether or not the student is born overseas. Language other than English spoken at home is the reported main language spoken at home other than English (if any). All languages other than English are bundled together as non-English speaking.
Regional classification of residence	These are categories of remoteness, measured by distance to major services, produced by the Australian Bureau of Statistics (ABS) (2011a). These categories were assigned to the residential postcodes in the VETPC using correspondence between residential postcode and remoteness areas obtained from the ABS.
Employed at time of enrolment	Students are asked which of a number of employment states *best* describes their current situation. Our binary measure of employed includes people who report being part-time employed, full-time employed and self-employed. All other states (unpaid worker, unemployed and looking for work and unemployed and not seeking work) are grouped together.
Has a disability	Student self-reported belief about whether they have a disability, impairment or long-term health condition. This information is used by colleges to identify students who may need extra support to cater for any special learning needs.
Socio-economic status of residential area	This is the relative disadvantage of the local government area (LGA) in which the student resides, measured using the Social Economic Index of Areas (SEIFA) produced by the Australian Bureau of Statistics (2011b). SEIFA is an ordinal index of regional disadvantage, combining measures such as percentage of people who are low income and percentage of people who have less than secondary school education from the Australian census. We break the national index into quintiles, where the lowest quintile contains the most disadvantaged postcodes in Australia. The SEIFA quintiles were assigned to students in the VETPC using concordance between postcode and LGA obtained from the Australian Bureau of Statistics.
Highest prior level of education completed	Highest prior education is a combination of information on the student reported highest year of school successfully completed and the reported Australian Standard Classification of Education

	(ASCED) post-school qualifications completed. The highest post-school qualification is determined according to the International Standard Classification of Education (ISCED) 1997 (United National Educational, Scientific and Cultural Organisation (UNESCO) 2006) qualification rankings and concordance between ASCED and ISCED (Australian Bureau of Statistics 2001).
College characteristics	
Number of enrolments in 2008	Number of 15-19 year-old new enrolments in 2008 for each college identified in VETPC between 2008 and 2011. New colleges that entered the market after 2008 are treated as a separate category.
Type of college	College type in the VETPC is classified according to the governance characteristics of the organisation providing the training. Technical and Further Education (TAFE) colleges are the main public colleges, which were created by Act of Parliament and have responsibilities specified in their establishing Acts, other legislation and Ministerial Directions. Adult and Community Education (ACE) colleges are also public colleges. They differ from TAFEs in that their primary focus is adult education and as well as providing nationally accredited courses for preparation for work, they also provide personal and recreational courses (that are not included in this study). The third type of public college is dual sector universities that offer both VET qualifications and bachelor degrees. In contrast to public colleges, private businesses (commercial colleges) are registered colleges that provide nationally recognised training on a for-profit basis. In between public and private businesses are enterprises, industry associations and other non-government organisations that are registered training organisations that provide nationally accredited training to meet the needs of their members or employees.
Course characteristics	
Course qualification level	Under the Australian Qualification Framework (AQF) (Australian Quality Framework Council 2013), nationally accredited VET courses are one of six ASCED levels from Certificate I through to Advanced Diploma. For the analysis, we combine Diploma level courses and Advanced Diploma level courses to produce five qualification categories. These are equivalent to ISCED (1997) 2C through to ISCED 5B (ABS 2001). There are also a small number of low level VET courses outside the AQF system that are termed certificates of attainment.
Field of study (4-digit ASCED)	The field of course study is at the 4-digit Australian Standard Classification of Education level (Australian Bureau of Statistics 2001). There are 71 categories in total.
National skill shortage indicator	Binary measure of whether the course is associated with preparation for work in a skill shortage occupation. Skill shortage occupations are those that at the start of the year of enrolment are listed by the Department of Education to be of national shortage. General courses of mixed field courses that are not associated with preparation for a particular occupation are coded zero. We also include a binary indicator for these courses.

Expected graduate earnings	This is identical to the dependent variable for course choice and represents the estimated log earnings premium (A$2013) for graduates for different field of study and course level combinations, relative to Building certificate level III. See the data description in section 3 for more information and Table A3 for the estimated earnings premia.

Table A2: Occupations on the National Skill Shortage List, 2006-2012[a]

	2006	2007	2008	2009	2010	2011	2012	Total
Construction Project Manager	0	0	0	0	0	1	1	2
Engineering Manager	0	0	1	1	0	1	1	4
Production Manager (Mining)	0	0	1	1	0	1	1	4
Child Care Centre Manager	1	1	1	1	1	1	1	7
Accountant (General)	1	1	1	1	0	0	0	4
Management Accountant	1	1	1	1	0	0	0	4
Taxation Accountant	1	1	1	1	0	0	0	4
External Auditor	0	1	1	1	0	0	0	3
Architect	0	1	1	1	0	0	0	3
Surveyor	0	1	1	1	1	1	1	6
Urban and Regional Planner	1	0	1	1	0	0	0	3
Chemical Engineer	1	1	1	1	1	0	0	5
Civil Engineer	1	1	1	1	1	1	1	7
Quantity Surveyor	0	1	1	1	1	1	1	6
Structural Engineer	1	1	1	1	1	1	1	7
Transport Engineer	1	1	1	1	1	1	1	7
Electrical Engineer	1	1	1	1	1	1	1	7
Electronics Engineer	0	0	1	1	0	0	0	2
Mechanical Engineer	0	1	1	1	0	1	1	5
Production or Plant Engineer	0	0	0	1	0	0	0	1
Mining Engineer (excluding Petroleum)	1	1	1	1	1	1	1	7
Petroleum Engineer	1	0	1	0	1	1	1	5
Agricultural Consultant	0	0	1	1	1	1	1	5
Agricultural Scientist	0	0	1	1	1	1	1	5
Forester (Aus) / Forest Scientist (NZ)	0	0	1	1	0	0	0	2
Geologist	1	1	1	1	0	1	1	6
Veterinarian	0	0	0	0	1	1	0	2
Metallurgist	1	0	0	0	0	0	0	1
Early Childhood (Pre-primary School) Teacher	0	0	0	0	1	1	1	3
Special Needs Teacher	0	0	0	0	1	0	0	1
Medical Diagnostic Radiographer	1	1	1	1	1	1	0	6
Medical Radiation Therapist	1	0	1	0	0	1	0	3
Nuclear Medicine Technologist	1	0	0	0	0	0	0	1
Sonographer	1	1	1	1	1	1	1	7
Optometrist	0	0	1	1	1	0	1	4
Hospital Pharmacist	1	1	1	1	0	0	0	4
Retail Pharmacist	1	1	1	1	0	0	0	4
Dental Specialist	1	1	1	1	1	0	0	5
Dentist	1	1	1	1	1	0	0	5
Occupational Therapist	1	1	1	1	1	0	0	5
Physiotherapist	1	1	1	1	1	1	1	7
Podiatrist	1	1	1	1	1	1	1	7

Audiologist	1	0	1	1	0	1	1	5
Speech Pathologist (Aus) / Speech Language Therapist (NZ)	1	1	1	1	1	0	1	6
Midwife	1	1	1	1	1	1	1	7
Nurse Educator	0	0	1	1	0	0	0	2
Nurse Researcher	0	0	0	0	0	0	0	0
Nurse Manager	0	0	1	1	0	0	0	2
Nurse Practitioner	1	1	1	1	1	1	1	7
Registered Nurse (Aged Care)	1	1	1	1	1	1	1	7
Registered Nurse (Child and Family Health)	1	1	1	1	1	1	1	7
Registered Nurse (Community Health)	1	1	1	1	1	1	1	7
Registered Nurse (Critical Care and Emergency)	1	1	1	1	1	1	1	7
Registered Nurse (Developmental Disability)	1	1	1	1	1	1	1	7
Registered Nurse (Disability and Rehabilitation)	1	1	1	1	1	1	1	7
Registered Nurse (Medical)	1	1	1	1	1	1	1	7
Registered Nurse (Medical Practice)	1	1	1	1	1	1	1	7
Registered Nurse (Mental Health)	1	1	1	1	1	1	1	7
Registered Nurse (Perioperative)	1	1	1	1	1	1	1	7
Registered Nurse (Surgical)	1	1	1	1	1	1	1	7
Registered Nurses nec	1	1	1	1	1	1	1	7
Clinical Psychologist	0	0	1	1	1	1	1	5
Social Worker	0	0	0	1	0	0	0	1
Welfare Worker	0	0	0	0	0	0	1	1
Agricultural Technician	0	0	0	0	1	0	0	1
Architectural Draftsperson	0	1	1	1	0	0	0	3
Building Associate	0	1	1	1	0	0	0	3
Construction Estimator	0	0	0	0	1	1	1	3
Surveying or Cartographic Technician	0	0	0	1	0	0	0	1
Civil Engineering Draftsperson	1	1	1	1	0	1	1	6
Civil Engineering Technician	1	1	1	1	0	1	1	6
Electrical Engineering Draftsperson	1	1	1	1	0	1	1	6
Electrical Engineering Technician	1	1	1	1	0	1	1	6
Electronic Engineering Draftsperson	1	1	1	1	0	1	1	6
Electronic Engineering Technician	1	1	1	1	0	1	1	6
Mechanical Engineering Draftsperson	1	1	1	1	0	1	1	6
Metallurgical or Materials Technician	1	1	1	1	0	1	1	6
Mine Deputy	1	1	1	1	0	1	1	6
Radiocommunications Technician	1	1	1	1	0	1	1	6
Automotive Electrician	1	1	1	1	0	1	1	6
Diesel Motor Mechanic	1	1	1	1	0	1	1	6
Motorcycle Mechanic	1	1	1	1	0	1	1	6
Small Engine Mechanic	1	1	1	1	0	1	1	6
Sheetmetal Trades Worker	1	1	1	1	0	1	1	6
Metal Fabricator	1	1	1	1	0	0	1	5
Welder (First Class) (Aus) / Welder (NZ)	1	1	1	1	0	0	0	4

Aircraft Maintenance Engineer (Avionics)	0	1	1	1	1	1	0	5
Aircraft Maintenance Engineer (Mechanical)	0	1	1	1	1	1	0	5
Fitter (General)	0	1	1	1	1	1	0	5
Fitter and Turner	0	1	1	1	1	1	0	5
Fitter-Welder	0	1	1	1	1	1	0	5
Metal Machinist (First Class)	1	1	1	1	0	1	1	6
Textile, Clothing and Footwear Mechanic	1	1	1	1	0	1	1	6
Metal Fitters and Machinists nec	1	1	1	1	0	1	1	6
Locksmith	1	1	1	1	1	1	1	7
Toolmaker	1	1	1	0	0	1	0	4
Panelbeater	1	1	1	1	1	1	1	7
Vehicle Body Builder	1	1	1	1	0	0	1	5
Vehicle Trimmer	0	1	1	1	1	1	1	6
Vehicle Painter	1	1	1	1	0	1	1	6
Bricklayer	1	1	1	1	0	1	0	5
Stonemason	1	1	1	1	0	0	0	4
Carpenter and Joiner	1	1	1	1	0	0	0	4
Carpenter	1	1	1	1	0	0	0	4
Joiner	1	1	1	1	0	0	0	4
Floor Finisher	1	1	1	1	1	0	0	5
Painting Trades Worker	0	1	1	1	0	0	0	3
Glazier	1	1	1	1	1	1	0	6
Fibrous Plasterer	1	1	1	1	0	1	1	6
Solid Plasterer	1	1	1	1	0	1	1	6
Roof Tiler	1	1	1	1	0	1	1	6
Wall and Floor Tiler	1	1	1	1	0	1	1	6
Plumber (General)	1	1	1	1	0	1	1	6
Airconditioning and Mechanical Services Plumber	1	1	1	1	0	1	1	6
Drainer (Aus) / Drainlayer (NZ)	1	1	1	1	0	1	1	6
Gasfitter	1	1	1	1	0	1	1	6
Roof Plumber	1	1	1	1	0	1	1	6
Electrician (General)	1	1	1	1	0	0	1	5
Electrician (Special Class)	1	0	0	0	0	0	0	1
Lift Mechanic	1	1	1	1	1	0	0	5
Airconditioning and Refrigeration Mechanic	1	1	1	1	1	1	1	7
Electrical Linesworker (Aus) / Electrical Line Mechanic (NZ)	1	1	1	1	1	1	1	7
Electronic Equipment Trades Worker	1	1	1	1	1	0	1	6
Electronic Instrument Trades Worker (General)	1	0	0	0	0	1	1	3
Cabler (Data and Telecommunications)	0	0	1	1	0	0	0	2
Telecommunications Cable Jointer	0	0	0	0	0	0	1	1
Telecommunications Linesworker (Aus) / Telecommunications Line Mechanic (NZ)	0	0	1	1	0	0	0	2
Telecommunications Technician	0	0	1	1	0	0	1	3
Baker	1	1	1	1	1	1	1	7

Pastrycook	1	1	1	1	1	1	0	6
Butcher or Smallgoods Maker	1	1	1	1	1	1	1	7
Chef	1	1	1	1	1	1	1	7
Cook	1	1	1	1	1	1	1	7
Shearer	0	0	1	1	0	0	1	3
Arborist	1	1	1	1	1	1	1	7
Landscape Gardener	0	0	1	1	1	0	1	4
Hairdresser	1	1	1	1	1	1	1	7
Binder and Finisher	1	1	1	1	1	1	0	6
Screen Printer	1	1	1	1	1	0	0	5
Graphic Pre-press Trades Worker	0	0	0	0	1	0	0	1
Printing Machinist	1	1	1	0	0	0	0	3
Small Offset Printer	1	0	0	0	0	0	0	1
Upholsterer	1	1	1	1	1	0	0	5
Cabinetmaker	1	1	1	1	1	1	0	6
Furniture Finisher	1	1	1	1	1	0	0	5
Picture Framer	0	1	1	1	1	0	0	4
Wood Machinist	0	1	1	1	0	0	0	3
Boat Builder and Repairer	1	1	1	1	0	0	1	5
Jeweller	0	0	0	0	1	0	1	2
Signwriter	0	1	1	1	1	0	0	4
Optical Dispenser (Aus) / Dispensing Optician (NZ)	0	1	1	1	1	0	0	4
Dental Technician	0	1	1	1	1	0	1	5
Enrolled Nurse	1	0	0	1	1	1	1	5
Child Care Worker	1	0	1	1	1	1	1	6
Miner	1	0	1	1	1	1	1	6
Total	107	114	135	135	77	94	94	756

Information on skill demand, including national shortage information used in the analysis is annual information from the year prior to enrolment (2005-2011). This is the best estimate of information available at the time course choice. Not on list does not necessarily mean that there is weak demand for course graduates trained for work in a given occupation. Occupations in the table (out of a total 998 occupations) are those that appear on the national skill shortage list at least once over the period of analysis. Occupations not on the national shortage list may be regionally, but not nationally, in shortage. In some cases, occupations may not be in the list because there is no evidence available on the extent of the skill shortage.

Table A3: Estimated log weekly wage coefficients ($A2013) by ISCED 4-digit field of study and qualification level

ISCED 4-digit field of study	Level	2006	2007	2008	2009	2010	2011	2012
Accounting	Cert. I	-0.09	-0.04	-0.05	-0.46	-0.01	-0.01	-0.03
Accounting	Cert. II	-0.02	-0.02	-0.04	-0.07	-0.04	-0.11	-0.06
Accounting	Cert. III	-0.13	-0.51	-0.46	-0.52	-0.10	-0.11	-0.15
Accounting	Cert. IV	-0.24	-0.13	-0.24	-0.20	-0.20	-0.20	-0.27
Accounting	Diploma+	-0.06	-0.29	-0.28	-0.37	-0.29	-0.33	-0.25
Aerospace Engineering and Technology	Cert. I	-0.31	-0.66	-0.14	-0.19	-0.15	-0.28	-0.09
Aerospace Engineering and Technology	Cert. II	-0.22	-0.59	-0.07	-0.10	-0.00	-0.20	-0.24
Aerospace Engineering and Technology	Cert. III	-0.04	-0.04	-0.01	-0.05	-0.03	-0.00	-0.01
Aerospace Engineering and Technology	Cert. IV	-0.04	-0.67	-0.36	-0.56	-0.50	-0.32	-0.19
Aerospace Engineering and Technology	Diploma+	-0.08	-0.18	-0.54	-0.35	-0.21	-0.14	-0.14
Agriculture	Cert. I	-0.08	-0.06	-0.21	-0.09	-0.08	-0.35	-0.15
Agriculture	Cert. II	-0.03	-0.22	-0.31	-0.19	-0.20	-0.07	-0.20
Agriculture	Cert. III	-0.08	-0.20	-0.20	-0.19	-0.20	-0.35	-0.00
Agriculture	Cert. IV	-0.08	-0.32	-0.12	-0.09	-0.20	-0.20	-0.24
Agriculture	Diploma+	-0.30	-0.15	-0.30	-0.04	-0.27	-0.64	-0.44
Architecture and Urban Environment	Cert. I	-0.18	-0.05	-0.10	-0.11	-0.24	-0.12	-0.18
Architecture and Urban Environment	Cert. II	-0.11	-0.23	-0.00	-0.43	-0.35	-0.12	-0.22
Architecture and Urban Environment	Cert. III	-	-	-	-	-	-	-
Architecture and Urban Environment	Cert. IV	-0.21	-0.31	-0.24	-0.35	-0.25	-0.30	-0.16
Architecture and Urban Environment	Diploma+	-0.11	-0.26	-0.15	-0.18	-0.18	-0.16	-0.21
Automotive Engineering and Technology	Cert. I	-0.03	-0.13	-0.05	-0.17	-0.47	-0.04	-0.03
Automotive Engineering and Technology	Cert. II	-0.07	-0.57	-0.14	-0.12	-0.16	-0.30	-0.24
Automotive Engineering and Technology	Cert. III	-0.05	-0.15	-0.08	-0.17	-0.12	-0.10	-0.09
Automotive Engineering and Technology	Cert. IV	-0.13	-0.16	-0.14	-0.22	-0.22	-0.21	-0.16
Automotive Engineering and Technology	Diploma+	-0.12	-0.28	-0.18	-0.31	-0.20	-0.27	-0.20
Banking, Finance and Related Fields	Cert. I	-0.05	-0.13	-0.01	-0.08	-0.11	-0.08	-0.08
Banking, Finance and Related Fields	Cert. II	-0.11	-0.10	-0.01	-0.04	-0.03	-0.01	-0.06

Banking, Finance and Related Fields	Cert. III	0.06	-0.05	-0.07	-0.13	-0.12	-0.06	-0.08
Banking, Finance and Related Fields	Cert. IV	-0.04	-0.15	-0.00	-0.28	-0.67	-0.11	-0.54
Banking, Finance and Related Fields	Diploma+	-0.06	-0.29	-0.28	-0.37	-0.29	-0.33	-0.25
Biological Sciences	Cert. I	0.40	-0.14	-0.19	-0.01	-0.14	-0.20	-0.02
Biological Sciences	Cert. II	-0.05	-0.32	-0.14	-0.29	-0.47	-0.07	-0.23
Biological Sciences	Cert. III	-0.18	-0.46	-0.09	-0.06	-0.04	-0.01	-0.02
Biological Sciences	Cert. IV	-	-	-0.92	-	-0.62	-0.27	-
Biological Sciences	Diploma+	-	-	-	-	-	-	-
Building	Cert. I	0.02	0.03	-0.03	-0.02	-0.08	-0.05	-0.00
Building	Cert. II	0.27	0.10	0.12	0.13	0.07	0.14	0.15
Building (reference case)	**Cert. III**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Building	Cert. IV	-0.22	-0.32	-0.25	-0.36	-0.27	-0.31	-0.17
Building	Diploma+	-0.12	-0.27	-0.15	-0.19	-0.19	-0.17	-0.22
Business and Management	Cert. I	0.11	0.05	0.06	-0.05	0.00	-0.04	-0.02
Business and Management	Cert. II	-0.03	-0.00	-0.06	-0.11	-0.03	-0.10	-0.08
Business and Management	Cert. III	-0.07	-0.02	-0.06	-0.22	-0.12	-0.16	-0.16
Business and Management	Cert. IV	-0.06	-0.35	-1.04	-0.51	-0.61	-0.11	-0.27
Business and Management	Diploma+	-0.35	-0.93	-0.14	-0.31	-0.29	-0.33	-0.25
Civil Engineering	Cert. I	0.11	0.03	0.16	-0.00	-0.12	-0.06	-0.03
Civil Engineering	Cert. II	-0.03	-0.46	-0.04	-0.12	-0.09	-0.13	-0.01
Civil Engineering	Cert. III	-0.03	-0.51	-0.08	-0.03	-0.20	-0.31	-0.08
Civil Engineering	Cert. IV	0.16	-0.13	-0.28	-0.60	-0.18	-0.05	-0.24
Civil Engineering	Diploma+	0.56	-0.18	-0.12	-0.09	-0.21	-0.14	-0.14
Communication and Media Studies	Cert. I	-0.24	-0.14	-0.06	-0.13	-0.22	-0.10	-0.36
Communication and Media Studies	Cert. II	-0.11	-0.23	-0.28	-0.26	-0.35	-0.32	-0.34
Communication and Media Studies	Cert. III	-0.30	-0.17	-0.35	-0.13	-0.19	-0.14	-0.45
Communication and Media Studies	Cert. IV	-0.08	-0.94	-0.58	-0.19	-0.19	-0.46	-0.66
Communication and Media Studies	Diploma+	-0.89	-0.15	-0.17	-0.40	-0.52	-0.89	-0.95
Complementary Therapies	Cert. I	-0.10	-0.04	-0.21	-0.18	-0.07	-0.18	-0.08
Complementary Therapies	Cert. II	-0.10	-0.58	-0.24	-0.09	-0.20	-0.16	-0.02
Complementary Therapies	Cert. III	-0.03	-0.02	-0.06	-0.07	-0.13	-0.04	-0.02

Complementary Therapies	Cert. IV	0.05	-0.26	-0.11	-0.11	-0.05	-0.16	-0.26
Complementary Therapies	Diploma+	0.78	-0.68	-	-0.30	-0.12	-0.24	-0.31
Computer Science	Cert. I	0.03	-0.04	-0.10	-0.13	-0.12	-0.22	-0.05
Computer Science	Cert. II	-0.13	-0.29	-0.03	-0.49	-0.19	-0.15	-0.21
Computer Science	Cert. III	-0.32	-0.26	-0.44	-0.64	-0.45	-0.13	-0.07
Computer Science	Cert. IV	-0.18	-0.31	-0.24	-0.27	-0.51	-0.09	-0.53
Computer Science	Diploma+	-	-	-0.55	-0.29	-	-	-
Curriculum and Education Studies	Cert. I	-0.29	-0.04	-0.12	-	-0.63	-0.70	-0.25
Curriculum and Education Studies	Cert. II	-0.12	-0.12	-0.11	-0.08	-0.06	-0.15	-0.06
Curriculum and Education Studies	Cert. III	-0.01	-0.79	-0.01	-0.12	-0.13	-0.81	-0.73
Curriculum and Education Studies	Cert. IV	-0.46	-	-0.75	-	-0.25	-	-0.29
Curriculum and Education Studies	Diploma+	-	-	-0.30	-	-0.01	-0.72	-0.60
Dental Studies	Cert. I	-0.40	-0.17	-0.38	-0.11	-0.17	-0.14	-0.02
Dental Studies	Cert. II	-0.30	-0.15	-0.00	-0.01	-0.01	-0.04	-0.10
Dental Studies	Cert. III	-0.02	-0.00	-0.05	-0.11	-0.13	-0.09	-0.01
Dental Studies	Cert. IV	-0.26	-0.26	-0.11	-0.11	-0.05	-0.16	-0.26
Dental Studies	Diploma+	-0.78	-0.68	-	-0.30	-0.12	-0.24	-0.31
Earth Sciences	Cert. I	-0.29	-0.22	-0.36	-0.04	-1.02	-0.02	-0.02
Earth Sciences	Cert. II	-0.10	-0.30	-0.07	-0.29	-2.11	-0.64	-0.11
Earth Sciences	Cert. III	-0.74	-0.43	-0.24	-0.06	-0.04	-0.01	-0.17
Earth Sciences	Cert. IV	-	-	-0.92	-	-0.62	-0.27	-
Earth Sciences	Diploma+	-	-	-	-	-	-	-
Electrical and Electronic Engineering and Technology	Cert. I	-0.07	-0.16	-0.07	-0.06	-0.00	-0.04	-0.07
Electrical and Electronic Engineering and Technology	Cert. II	-0.33	-0.13	-0.32	-0.59	-0.23	-0.40	-0.03
Electrical and Electronic Engineering and Technology	Cert. III	-0.15	-0.10	-0.14	-0.12	-0.08	-0.10	-0.15
Electrical and Electronic Engineering and Technology	Cert. IV	-0.12	-0.29	-0.29	-0.36	-0.13	-0.36	-0.27
Electrical and Electronic Engineering and Technology	Diploma+	-0.22	-0.32	-0.17	-0.44	-0.28	-0.13	-0.05
Employment Skills Programmes	Cert. I	-	-0.51	-0.26	-0.49	-0.61	-0.13	-0.16
Employment Skills Programmes	Cert. II	-0.07	-0.32	-0.52	-0.13	-0.52	-0.06	-0.29
Employment Skills Programmes	Cert. III	-0.11	-1.47	-0.25	-0.06	-0.38	-0.48	-0.02

Employment Skills Programmes	Cert. IV	-0.24	-0.14	-0.27	-0.45	-0.18	-0.33	-0.15
Employment Skills Programmes	Diploma+	-0.17	-0.31	-0.54	-0.25	-0.27	-0.17	-0.25
Environmental Studies	Cert. I	-0.07	-0.05	-0.08	-0.29	-0.13	-0.15	-0.13
Environmental Studies	Cert. II	-0.25	-0.16	-0.09	-0.22	-0.07	-0.10	-0.13
Environmental Studies	Cert. III	-0.08	-0.42	-0.13	-0.01	-0.01	-0.23	-0.12
Environmental Studies	Cert. IV	-0.03	-0.10	-0.15	-0.65	-0.11	-0.19	-0.26
Environmental Studies	Diploma+	-0.04	-0.44	-0.05	-0.75	-0.37	-0.29	-0.50
Fisheries Studies	Cert. I	-0.32	-0.01	-1.15	-0.03	-0.12	-0.31	-0.40
Fisheries Studies	Cert. II	-0.07	-0.17	-0.27	-0.35	-0.35	-0.04	-0.08
Fisheries Studies	Cert. III	-0.09	-0.21	-0.11	-0.54	-0.37	-0.19	-0.06
Fisheries Studies	Cert. IV	-0.40	-0.27	-0.35	-0.31	-0.32	-0.45	-0.03
Fisheries Studies	Diploma+	-0.26	-0.27	-0.50	-0.01	-0.18	-0.28	-0.46
Food and Hospitality	Cert. I	-0.22	-0.07	-0.11	-0.21	-0.03	-0.29	-0.03
Food and Hospitality	Cert. II	-0.06	-0.11	-0.07	-0.18	-0.02	-0.14	-0.03
Food and Hospitality	Cert. III	-0.06	-0.06	-0.10	-0.12	-0.13	-0.10	-0.14
Food and Hospitality	Cert. IV	-0.08	-0.12	-0.11	-0.26	-0.21	-0.13	-0.19
Food and Hospitality	Diploma+	-0.01	-0.06	-0.19	-0.14	-0.32	-0.04	-0.24
Forestry Studies	Cert. I	-0.03	-0.01	-0.22	-0.03	-0.03	-0.31	-0.12
Forestry Studies	Cert. II	-0.07	-0.09	-0.27	-0.17	-0.19	-0.06	-0.03
Forestry Studies	Cert. III	-0.09	-0.15	-0.07	-0.18	-0.08	-0.10	-0.21
Forestry Studies	Cert. IV	-0.05	-0.18	-0.15	-0.14	-0.14	-0.14	-0.09
Forestry Studies	Diploma+	-0.46	-0.41	-0.37	-0.14	-0.23	-0.29	-0.46
General Education Programmes	Cert. I	-	-0.49	-0.25	-0.49	-0.09	-0.76	-0.28
General Education Programmes	Cert. II	-0.05	-0.46	-0.32	-0.25	-0.28	-0.05	-0.30
General Education Programmes	Cert. III	-0.08	-0.44	-0.14	-0.13	-0.14	-0.11	-0.16
General Education Programmes	Cert. IV	-0.02	-0.11	-0.00	-0.11	-0.24	-0.08	-0.28
General Education Programmes	Diploma+	-0.32	-0.50	-0.19	-0.46	-0.23	-0.33	-0.08
Geomatic Engineering	Cert. I	-0.19	-0.48	-0.44	-0.11	-0.15	-0.13	-0.20
Geomatic Engineering	Cert. II	-0.17	-0.07	-0.04	-0.12	-1.00	-0.79	-0.40
Geomatic Engineering	Cert. III	-0.10	-0.04	-0.26	-0.63	-0.27	-0.27	-0.16

Geomatic Engineering	Cert. IV	0.30	-0.13	-0.02	-1.65	-0.56	-0.67	-0.18
Geomatic Engineering	Diploma+	-0.08	-0.18	-0.12	-0.35	-0.21	-0.14	-0.14
Graphic and Design Studies	Cert. I	0.00	-0.09	-0.10	-0.16	-0.22	-0.05	-0.21
Graphic and Design Studies	Cert. II	-0.10	-0.02	-0.28	-0.21	-0.24	-0.29	-0.28
Graphic and Design Studies	Cert. III	-0.17	-0.18	-0.31	-0.41	-0.41	-0.03	-0.38
Graphic and Design Studies	Cert. IV	-0.02	-0.08	-0.37	-0.24	-0.71	-0.38	-0.47
Graphic and Design Studies	Diploma+	-0.89	-0.15	-0.17	-0.40	-0.52	-0.89	-0.73
Horticulture and Viticulture	Cert. I	-0.01	-0.05	-0.13	-0.25	-0.02	-0.37	-0.11
Horticulture and Viticulture	Cert. II	-0.04	-0.03	-0.42	-0.12	-0.35	-0.10	-0.06
Horticulture and Viticulture	Cert. III	-0.02	-0.26	-0.15	-0.32	-0.14	-0.15	-0.19
Horticulture and Viticulture	Cert. IV	-0.08	-0.26	-0.14	-0.27	-0.17	-0.26	-0.19
Horticulture and Viticulture	Diploma+	-0.19	-0.59	-0.51	-0.31	-0.54	-0.30	-0.60
Human Welfare Studies and Services	Cert. I	-0.02	-0.04	-0.02	-0.18	-0.02	-0.03	-0.06
Human Welfare Studies and Services	Cert. II	-0.01	-0.18	-0.01	-0.27	-0.09	-0.06	-0.04
Human Welfare Studies and Services	Cert. III	-0.05	-0.12	-0.03	-0.08	-0.03	-0.02	-0.05
Human Welfare Studies and Services	Cert. IV	-0.18	-0.20	-0.92	-0.22	-0.29	-0.05	-0.38
Human Welfare Studies and Services	Diploma+	-0.15	-0.20	-0.05	-0.29	-0.36	-0.05	-0.34
Information Systems	Cert. I	-0.10	-0.16	-0.07	-0.14	-0.06	-0.02	-0.01
Information Systems	Cert. II	-0.00	-0.19	-0.19	-0.11	-0.04	-0.09	-0.16
Information Systems	Cert. III	-0.08	-0.25	-0.27	-0.26	-0.21	-0.25	-0.28
Information Systems	Cert. IV	-0.04	-0.10	-0.26	-0.24	-0.03	-0.08	-0.45
Information Systems	Diploma+	-	-	-0.56	-0.31	-	-	-
Justice and Law Enforcement	Cert. I	-0.07	-0.14	-0.04	-0.12	-0.09	-0.03	-0.22
Justice and Law Enforcement	Cert. II	-0.06	-0.15	-0.07	-0.07	-0.15	-0.06	-0.06
Justice and Law Enforcement	Cert. III	-0.05	-0.16	-0.02	-0.03	-0.22	-0.10	-0.06
Justice and Law Enforcement	Cert. IV	-0.18	-0.07	-0.40	-0.75	-0.49	-0.05	-0.31
Justice and Law Enforcement	Diploma+	-0.15	-0.20	-0.05	-0.29	-0.36	-0.05	-0.34
Language and Literature	Cert. I	-0.22	-0.14	-0.18	-0.47	-0.41	-0.17	-0.16
Language and Literature	Cert. II	-0.45	-0.52	-0.02	-0.22	-0.05	-0.05	-0.65
Language and Literature	Cert. III	-0.28	-0.25	-0.14	-0.08	-0.10	-0.14	-0.18

Language and Literature	Cert. IV	0.03	0.06	-0.08	-0.11	0.00	0.23	0.00
Language and Literature	Diploma+	-0.04	-0.18	0.02	-0.21	-0.26	-0.11	-0.33
Law	Cert. I	-0.38	-0.16	-0.01	-0.34	-0.04	-0.06	-0.10
Law	Cert. II	-0.06	-0.12	-0.16	-0.56	-0.18	-0.02	-0.07
Law	Cert. III	-0.03	-0.11	-0.01	-0.08	-0.05	-0.03	-0.08
Law	Cert. IV	-0.18	-0.07	-0.17	-0.22	-0.16	-0.05	-0.31
Law	Diploma+	-0.15	-0.20	-0.05	-0.29	-0.36	-0.05	-0.34
Librarianship, Information Management and Curatorial Studies	Cert. I	-0.23	-0.11	-0.03	-0.06	-0.08	-0.01	-0.14
Librarianship, Information Management and Curatorial Studies	Cert. II	-0.34	-0.12	-0.33	-0.20	-0.03	-0.02	-0.24
Librarianship, Information Management and Curatorial Studies	Cert. III	-0.03	-0.06	-0.54	-0.14	-0.24	-0.24	-0.33
Librarianship, Information Management and Curatorial Studies	Cert. IV	-0.13	-0.80	-0.22	-0.18	-0.06	-0.57	-0.31
Librarianship, Information Management and Curatorial Studies	Diploma+	-0.15	-0.20	-0.05	-0.29	-0.36	-0.05	-0.34
Manufacturing Engineering and Technology	Cert. I	-0.00	-0.18	-0.09	-0.12	-0.23	-0.08	-0.13
Manufacturing Engineering and Technology	Cert. II	-0.09	-0.30	-0.17	-0.42	-0.04	-0.12	-0.03
Manufacturing Engineering and Technology	Cert. III	-0.11	-0.23	-0.20	-0.27	-0.17	-0.11	-0.21
Manufacturing Engineering and Technology	Cert. IV	-0.02	-0.06	-0.21	-0.35	-0.52	-0.19	-0.29
Manufacturing Engineering and Technology	Diploma+	-0.07	-0.35	-0.09	-0.59	-0.06	-0.10	-0.15
Maritime Engineering and Technology	Cert. I	-0.03	-0.13	-0.05	-0.02	-0.08	-0.04	1.34
Maritime Engineering and Technology	Cert. II	-0.43	-0.07	-0.08	-0.12	-0.31	-0.40	-0.78
Maritime Engineering and Technology	Cert. III	-0.09	-0.14	-0.09	-0.20	-0.15	-0.00	-0.12
Maritime Engineering and Technology	Cert. IV	-0.27	-0.08	-0.05	-0.02	-0.01	-0.20	-0.03
Maritime Engineering and Technology	Diploma+	-0.15	-0.28	-0.16	-0.31	-0.42	-0.06	-0.00
Mechanical and Industrial Engineering and Technology	Cert. I	-0.03	-0.16	-0.12	-0.22	-0.01	-0.11	-0.05
Mechanical and Industrial Engineering and Technology	Cert. II	-0.26	-0.20	-0.09	-0.19	-0.12	-0.23	-0.15
Mechanical and Industrial Engineering and Technology	Cert. III	-0.13	-0.06	-0.03	-0.06	-0.03	-0.02	-0.09
Mechanical and Industrial Engineering and Technology	Cert. IV	-0.11	-0.22	-0.06	-0.26	-0.20	-0.19	-0.21
Mechanical and Industrial Engineering and Technology	Diploma+	-0.06	-0.07	-0.04	-0.19	-0.20	-0.13	-0.15
Medical Studies	Cert. I	-0.05	-0.04	-0.04	-0.03	-0.23	-0.06	-0.06
Medical Studies	Cert. II	-0.08	-0.07	-0.07	-0.06	-0.16	-0.01	-0.12
Medical Studies	Cert. III	-0.03	-0.02	-0.06	-0.07	-0.13	-0.04	-0.02

Medical Studies	Cert. IV	0.05	-0.26	-0.11	-0.11	-0.05	-0.16	-0.26
Medical Studies	Diploma+	0.78	-0.68	-	-0.30	-0.12	-0.24	-0.31
Nursing	Cert. I	0.33	-0.06	0.15	0.09	0.09	0.11	0.10
Nursing	Cert. II	0.19	0.11	0.13	0.14	0.09	0.20	0.17
Nursing	Cert. III	0.55	-0.02	1.03	-0.07	-0.13	-0.04	-0.23
Nursing	Cert. IV	0.05	-0.13	-0.31	-0.45	-0.50	-0.16	-0.26
Nursing	Diploma+	0.78	-0.68	-	-0.30	-0.12	-0.24	-0.31
Office Studies	Cert. I	0.09	-0.04	-0.05	-0.03	-0.01	-0.01	-0.03
Office Studies	Cert. II	0.21	-0.02	-0.04	-0.07	-0.03	-0.07	-0.32
Office Studies	Cert. III	0.00	-0.13	-0.11	-0.17	-0.17	-0.15	-0.15
Office Studies	Cert. IV	0.03	-0.14	-0.10	-0.25	-0.20	-0.22	-0.28
Office Studies	Diploma+	0.03	-0.23	-0.24	-0.40	-0.30	-0.38	-0.23
Optical Science	Cert. I	0.05	0.04	-0.02	-0.03	0.11	0.06	0.06
Optical Science	Cert. II	0.25	0.38	-0.02	-0.02	0.29	0.11	-0.09
Optical Science	Cert. III	0.03	-0.02	-0.06	-0.07	-0.47	-0.04	-0.02
Optical Science	Cert. IV	0.05	-0.26	-0.11	-0.11	-0.05	-0.16	-0.26
Optical Science	Diploma+	0.78	-0.68	-	-0.30	-0.12	-0.24	-0.31
Other Agriculture, Environmental and Related Studies	Cert. I	0.03	-0.01	-0.18	-0.03	-0.03	-0.31	-0.12
Other Agriculture, Environmental and Related Studies	Cert. II	0.07	-0.17	-0.27	-0.17	-0.19	-0.04	-0.16
Other Agriculture, Environmental and Related Studies	Cert. III	0.07	-0.03	-0.07	-0.24	-0.32	-0.51	-0.19
Other Agriculture, Environmental and Related Studies	Cert. IV	0.49	-0.73	-0.40	-0.34	-0.33	-0.13	-1.19
Other Agriculture, Environmental and Related Studies	Diploma+	0.10	-0.42	-0.37	-0.14	-0.23	-0.29	-0.46
Other Creative Arts	Cert. I	0.39	-0.13	-0.42	-0.18	-0.22	-0.14	-0.26
Other Creative Arts	Cert. II	0.19	-0.38	-0.77	-0.12	-1.55	-0.51	-0.31
Other Creative Arts	Cert. III	0.06	-0.16	-0.24	-0.15	-0.29	-0.18	-0.37
Other Creative Arts	Cert. IV	0.48	-0.46	-0.16	-0.51	-0.66	-0.70	-0.47
Other Creative Arts	Diploma+	0.89	-0.15	-0.17	-0.40	-0.52	-0.89	-0.73
Other Education	Cert. I	0.29	-0.98	-0.12	-0.88	-0.70	-0.24	
Other Education	Cert. II	0.17	-0.16	-0.11	-0.09	-0.10	-0.16	-0.08
Other Education	Cert. III	0.04	-0.08	-0.15	-0.27	-0.32	-0.48	-0.25

Other Education	Cert. IV	-0.46	-	-0.75	-	-0.25	-	-0.29
Other Education	Diploma+	-	-	-0.31	-	-0.07	-0.96	-
Other Engineering and Related Technologies	Cert. I	-0.10	-0.19	-0.06	-0.29	-0.11	-0.04	-0.36
Other Engineering and Related Technologies	Cert. II	-0.28	-0.47	-0.13	-0.40	-0.13	-0.25	-0.20
Other Engineering and Related Technologies	Cert. III	-0.29	-0.00	-0.08	-0.41	-0.27	-0.16	-0.04
Other Engineering and Related Technologies	Cert. IV	-0.04	-0.18	-0.26	-0.29	-0.05	-0.00	-0.20
Other Engineering and Related Technologies	Diploma+	-1.00	-0.18	-0.12	-0.35	-0.21	-0.14	-0.14
Other Health	Cert. I	-0.05	-0.24	-0.04	-0.31	-0.15	-0.06	-0.20
Other Health	Cert. II	-0.75	-0.07	-0.22	-0.06	-0.12	-0.34	-0.13
Other Health	Cert. III	-0.09	-0.01	-0.06	-0.16	-0.16	-0.04	-0.03
Other Health	Cert. IV	-0.05	-0.26	-0.11	-0.11	-0.05	-0.16	-0.26
Other Health	Diploma+	-0.78	-0.68	-	-0.30	-0.12	-0.24	-0.31
Other Information Technology	Cert. I	-0.10	-0.88	-0.16	-0.11	-0.10	-0.78	-0.07
Other Information Technology	Cert. II	-0.17	-0.02	-0.11	-0.23	-0.33	-0.21	-0.15
Other Information Technology	Cert. III	-0.08	-0.24	-0.35	-0.34	-0.25	-0.22	-0.27
Other Information Technology	Cert. IV	-0.25	-0.12	-0.24	-0.23	-0.47	-0.57	-0.56
Other Information Technology	Diploma+	-	-	-0.55	-0.29	-	-	-
Other Management and Commerce	Cert. I	-0.44	-0.11	-0.05	-0.45	-0.06	-0.04	-0.59
Other Management and Commerce	Cert. II	-0.02	-0.02	-0.04	-0.07	-0.35	-0.11	-0.09
Other Management and Commerce	Cert. III	-0.04	-0.07	-0.06	-0.12	-0.09	-0.10	-0.15
Other Management and Commerce	Cert. IV	-0.04	-0.07	-0.06	-0.06	-0.27	-0.63	-0.27
Other Management and Commerce	Diploma+	-0.08	-1.44	-2.40	-0.15	-0.29	-0.48	-0.28
Other Mixed Field Programmes	Cert. I	-	-0.49	-0.25	-0.48	-0.23	-0.17	-0.38
Other Mixed Field Programmes	Cert. II	-0.07	-0.44	-0.30	-0.23	-0.26	-0.69	-0.54
Other Mixed Field Programmes	Cert. III	-0.22	-0.11	-0.29	-0.09	-0.56	-0.17	-0.13
Other Mixed Field Programmes	Cert. IV	-0.04	-0.03	-0.01	-0.23	-0.12	-0.49	-0.14
Other Mixed Field Programmes	Diploma+	-0.25	-0.39	-1.81	-0.27	-0.45	-0.82	-0.21
Other Natural and Physical Sciences	Cert. I	-0.29	-0.63	-0.23	-0.08	-0.11	-0.12	-0.02
Other Natural and Physical Sciences	Cert. II	-0.25	-0.30	-0.07	-0.31	-0.15	-0.04	-0.31
Other Natural and Physical Sciences	Cert. III	-0.31	-0.36	-0.06	-0.08	-0.06	-0.00	-0.02

Other Natural and Physical Sciences	Cert. IV	-	-	-0.94	-	-0.64	-0.28	-
Other Natural and Physical Sciences	Diploma+	-	-	-	-	-	-	-
Other Society and Culture	Cert. I	0.04	-0.05	0.00	-0.15	0.03	0.00	-0.10
Other Society and Culture	Cert. II	-0.06	-0.12	-0.03	-0.20	-0.01	-0.02	-0.07
Other Society and Culture	Cert. III	0.42	0.05	-0.25	0.00	-0.05	-0.03	-0.08
Other Society and Culture	Cert. IV	-0.03	-0.30	-0.11	-0.10	-0.16	-0.05	-0.31
Other Society and Culture	Diploma+	-0.15	-0.20	-0.53	-0.29	-0.36	-0.05	-0.34
Performing Arts	Cert. I	-0.06	-0.24	-0.07	-0.19	-0.22	-0.11	-0.33
Performing Arts	Cert. II	-0.43	-0.78	-0.20	-0.13	-0.31	-0.31	-0.37
Performing Arts	Cert. III	-0.06	-0.19	-0.16	-0.10	-0.25	-0.30	-0.34
Performing Arts	Cert. IV	-0.20	-0.47	-0.25	-0.07	-0.27	-0.37	-0.53
Performing Arts	Diploma+	-0.97	-1.09	-0.04	-0.45	-0.52	-0.49	-0.73
Personal Services	Cert. I	0.22	0.00	0.00	-0.18	-0.02	-0.28	-0.03
Personal Services	Cert. II	-0.12	-0.32	-0.02	-0.16	-0.17	-0.25	-0.21
Personal Services	Cert. III	-0.08	-0.18	-0.20	-0.22	-0.19	-0.17	-0.20
Personal Services	Cert. IV	-0.16	-0.24	-0.22	-0.32	-0.29	-0.19	-0.31
Personal Services	Diploma+	-0.54	-0.34	-0.54	-0.77	-0.05	-0.04	-0.24
Political Science and Policy Studies	Cert. I	0.04	0.40	0.50	-0.15	-0.03	0.00	-0.10
Political Science and Policy Studies	Cert. II	0.21	0.05	0.21	-0.28	-0.05	-0.10	-0.07
Political Science and Policy Studies	Cert. III	-0.03	-0.67	-0.12	-0.49	-0.04	-0.22	-0.04
Political Science and Policy Studies	Cert. IV	-0.01	-0.01	-0.71	-0.14	-0.16	-0.05	-0.31
Political Science and Policy Studies	Diploma+	-0.15	-0.20	-0.05	-0.29	-0.36	-0.05	-0.34
Process and Resources Engineering	Cert. I	0.25	-0.46	-0.21	-0.20	-0.26	-0.03	-0.24
Process and Resources Engineering	Cert. II	-0.03	-0.09	-0.36	-0.12	-0.31	-0.09	-0.14
Process and Resources Engineering	Cert. III	-0.04	-0.01	-0.01	-0.07	-0.06	-0.11	-0.01
Process and Resources Engineering	Cert. IV	0.35	0.43	-0.09	-0.07	-0.18	-0.07	-0.11
Process and Resources Engineering	Diploma+	-0.04	-0.04	-0.14	-0.47	-0.10	-0.06	-0.11
Public Health	Cert. I	-0.32	-0.20	-0.31	-0.03	-0.29	-0.42	-0.34
Public Health	Cert. II	-0.04	-0.01	-0.09	-0.09	-0.09	-0.02	-0.21
Public Health	Cert. III	-0.24	-0.25	-0.10	-0.09	-0.12	-0.10	-0.14
Public Health	Cert. IV	-0.05	-0.58	-0.09	-0.11	-0.26	-0.22	-0.23

Public Health	Diploma+	0.78	-0.68	-0.30	-0.12	-0.24	-0.31	
Rehabilitation Therapies	Cert. I	-0.12	-0.21	-0.20	-0.26	-0.22	-0.91	-0.07
Rehabilitation Therapies	Cert. II	0.31	0.23	-0.49	0.06	-0.04	0.01	-0.03
Rehabilitation Therapies	Cert. III	-0.03	-1.01	-0.06	-0.07	-0.13	-0.04	-0.02
Rehabilitation Therapies	Cert. IV	-0.05	-0.26	-0.11	-0.11	-0.05	-0.16	-0.26
Rehabilitation Therapies	Diploma+	0.78	-0.68	-0.30	-0.12	-0.24	-0.31	
Sales and Marketing	Cert. I	-0.01	-0.03	-0.01	-0.06	-0.00	-0.09	-0.03
Sales and Marketing	Cert. II	-0.08	-0.01	-0.05	-0.07	-0.07	-0.06	-0.12
Sales and Marketing	Cert. III	-0.02	-0.10	-0.14	-0.20	-0.19	-0.13	-0.13
Sales and Marketing	Cert. IV	-0.07	-0.20	-0.14	-0.33	-0.23	-0.22	-0.27
Sales and Marketing	Diploma+	-0.10	-0.25	-0.42	-0.45	-0.34	-0.21	-0.50
Social Skills Programmes	Cert. I	-	-0.49	-0.25	-0.48	-0.30	-0.17	-0.13
Social Skills Programmes	Cert. II	-0.07	-0.44	-0.00	-1.08	-0.26	-0.02	-0.29
Social Skills Programmes	Cert. III	-0.68	-0.28	-0.36	-0.11	-0.17	-0.17	-0.13
Social Skills Programmes	Cert. IV	-0.42	-0.49	-0.11	-0.23	-0.03	-0.19	-0.11
Social Skills Programmes	Diploma+	-1.76	-0.39	-0.61	-0.20	-0.30	-0.16	-0.67
Sport and Recreation	Cert. I	-0.09	-0.23	-0.02	-0.10	-0.11	-0.05	-0.15
Sport and Recreation	Cert. II	-0.09	-0.04	-0.11	-0.27	-0.11	-0.03	-0.09
Sport and Recreation	Cert. III	-0.06	-0.08	-0.11	-0.19	-0.13	-0.15	-0.15
Sport and Recreation	Cert. IV	-0.29	-0.03	-0.25	-0.49	-0.33	-0.17	-0.65
Sport and Recreation	Diploma+	-0.45	-0.33	-0.24	-0.83	-0.59	-1.17	-0.34
Teacher Education	Cert. I	-0.30	-0.54	-0.11	-0.14	-0.68	-0.25	
Teacher Education	Cert. II	-0.13	-0.16	-0.08	-0.10	-0.10	-0.10	-0.01
Teacher Education	Cert. III	-0.15	-0.60	-0.06	-0.10	-0.06	-0.06	-0.03
Teacher Education	Cert. IV	-0.49	-	-0.74	-	-0.26	-	-0.30
Teacher Education	Diploma+	-	-	-0.30	-	-0.09	-0.58	-0.85
Tourism	Cert. I	-0.09	-0.04	-0.97	-0.03	-0.01	-0.62	-0.03
Tourism	Cert. II	-0.29	-0.02	-0.05	-0.89	-0.37	-0.23	-0.03
Tourism	Cert. III	-0.05	-0.03	-0.13	-0.13	-0.14	-0.01	-0.16
Tourism	Cert. IV	-0.07	-0.07	-0.10	-0.41	-0.15	-0.09	-0.02

Tourism	Diploma+	-0.06	-0.29	-0.28	-0.37	-0.29	-0.33	-0.25
Veterinary Studies	Cert. I	0.45	0.30	0.21	-0.29	0.51	0.51	-0.26
Veterinary Studies	Cert. II	0.10	0.08	0.13	-0.14	-0.04	-0.02	-0.07
Veterinary Studies	Cert. III	0.14	-0.01	-0.16	-0.10	-0.22	-0.06	-0.15
Veterinary Studies	Cert. IV	0.00	-0.19	-0.10	-0.11	-0.12	-0.14	-0.30
Veterinary Studies	Diploma+	0.78	-0.71	-	-0.34	-0.15	-0.26	-0.32
Visual Arts and Crafts	Cert. I	-0.12	-0.11	-0.20	-0.37	-0.24	-0.42	-0.20
Visual Arts and Crafts	Cert. II	-0.13	-0.24	-0.07	-0.04	-0.28	-0.26	-0.29
Visual Arts and Crafts	Cert. III	-0.04	-0.13	-0.27	-0.09	-0.32	-0.36	-0.29
Visual Arts and Crafts	Cert. IV	-0.21	-0.21	-0.28	-0.04	-0.23	-0.16	-0.33
Visual Arts and Crafts	Diploma+	-0.89	-0.74	-0.42	-0.35	-0.51	-2.02	-0.54

:These estimates are from a log wage regression model estimated on those aged 15-25 at the time of survey (around six months after completing their VET course) and who are not in study at the time of survey (used to generate our measure for expected course returns, adjusted for student characteristics). The dependent variable is weekly wage in 2013 Australian dollar terms, adjusted using the 2007-2013 wage price index by state (Australian Bureau of Statistics 2013). All regression models are estimated with controls for age, gender, state and region of residence, full-time employment status, disability status, highest prior education status, indigenous status, whether from a non-English speaking background, English speaking proficiency, employment status prior to study, whether training is part of an apprenticeship/traineeship and whether first job after finishing training. The reference case is Building Certificate level III, which was chosen because of the large number of observations and because it is a qualification that is easily recognisable (the typical qualification attained to become a builder in Australia). The size of the sample doubles every two years.

- is insufficient number of observations in the Student Outcome Survey to estimate results at the ISCED 4-digit and course level and ref. is reference case in the estimation (Building, Certificate III).

Source: Student Outcome Survey 2007, 2008, 2009 and 2010.

Table A4: Differences in trends between Victoria and the rest of Australia during the pre-treatment period

Model coefficient	Course choice		Course completion	
δ_p	National skill shortage	Expected graduate earnings	Module completion	Course completion
2006	ref. case	ref. case	ref. case	ref. case
2007	0.000	-0.037***	-0.015**	-0.031*
	(0.008)	(0.004)	(0.006)	(0.015)
2008	-0.031**	-0.005	-0.008	-0.065***
	(0.012)	(0.006)	(0.014)	(0.018)
2009	-0.023*	-0.015**	-0.025	-0.055**
	(0.011)	(0.006)	(0.016)	(0.018)
$F_{\delta_{2007}=\delta_{2008}=\delta_{2009}=0}$	6.95**	43.79***	75.88***	19.73***
Count	783,289	835,455	838,748	854,023

***Significant at 1%, **significant at 5% and *significant at 10%. Standard errors are robust-clustered at the state and territory level with critical values based on T(8-1) distribution. These represent coefficients on interaction terms between the dummy variable of Victorian enrolment and individual year dummies. All models are estimated with a full set of controls (as reported in Table 2). The F-statisitc is from a Waldt test that there are no diverging pre-reform trends between Victoria and the rest of Australia. We also estimate models excluding 2009 because it may contain both anticipation and treatment effects, but results are similar. The corresponding F-statistics are 8.37, 64.08, 64.0 and 29.09.

Table A5: Courses that averaged more than a 500 per year student increase in enrolment in Victoria following the VTG

Course name	Level	Field of study	Associated occupation	Post-reform years in shortage	Change in average annual enrolment post-reform (2010-12) relative to pre-reform (2006-2009)			
					Public	Private	Total	%
Hospitality	Cert. III	General Education	n.a.	n.a.	1384	2135	3519	247
General Education For Adults	Cert. II	General Education	n.a.	n.a.	3133	160	3292	131
Vocational Preparation	Cert. I	General Education	n.a.	n.a.	1790	833	2623	-
General Education For Adults	Cert. I	General Education	n.a.	n.a.	2447	-5	2442	109
Hospitality	Cert. II	Food and Hospitality	n.a.	n.a.	1505	924	2429	129
Carpentry	Cert. III	Building	Carpenters and Joiners	0	1574	461	2035	8481
Retail	Cert. III	Sales and Marketing	Sales Assistants (General)	0	431	1557	1988	298
Retail	Cert. II	Sales and Marketing	Sales Assistants (General)	0	546	1405	1951	120
Children's Services	Cert. III	Human Welfare Studies and Services	Child Carers	3	1299	578	1876	8934
Construction	Cert. I	Building	Building and Plumbing Labourers	0	1266	8	1275	-
Business Administration	Cert. IV	Business and Management	Office Managers	0	184	1024	1208	581
Business Administration	Cert. III	Office Studies	General Clerks	0	321	849	1170	159
Business	Cert. II	Office Studies	General Clerks	0	327	809	1136	113
General Education For Adults (Introductory)	Cert. I	General Education	n.a.	n.a.	1132	-3	1129	157
Plumbing	Cert. III	Building	Plumbers	2	1048	49	1097	4220
Hairdressing	Cert. III	Personal Services	Hairdressers	3	559	434	993	-
Electrotechnology Electrician	Cert. III	Electrical and Electronic Engineering and Technology	Electricians	1	831	153	984	114
Victorian Certificate Of Applied Learning (Foundation)	Cert. I	General Education	n.a.	n.a.	876	27	903	-
General Education For Adults	Cert. III	General Education	n.a.	n.a.	784	75	859	118

Hospitality (Commercial Cookery	Cert. III	Food and Hospitality	Cooks	3	641	143	784	131
Building And Construction (Bricklaying, Carpentry, Painting And Decorating)	Cert. II	Building	Wall and Floor Tilers	0	690	42	731	27
Electrotechnology Studies (Pre-Vocational)	Cert. II	Electrical and Electronic Engineering and Technology	n.a.	n.a.	650	67	717	79
Transport And Logistics (Warehousing)	Cert. III	Other Engineering and Related Technologies	Storepersons	0	52	637	689	565
Business	Cert. III	Office Studies	General Clerks	0	221	416	637	96
Children's Services (Early Childhood Education)	Diploma+	Human Welfare Studies and Services	Child Care Centre Managers	3	524	109	634	7042
Fitness	Cert. IV	Sport and Recreation	Fitness Instructors	0	98	487	584	115
Aged Care	Cert. III	Human Welfare Studies and Services	Aged and Disabled Carers	0	387	192	579	6431
Business	Cert. III	Office Studies	General Clerks	0	117	457	573	-
Customer Contact	Cert. III	Sales and Marketing	Call or Contact Centre Workers	0	4	564	567	247
Hospitality (Kitchen Operations)	Cert. II	Food and Hospitality	Kitchenhands	0	444	96	539	65
All Courses					19007	13606	32613	53

There are VET 3742 courses with at least one enrolled student between 2006 and 2012 in Australia. n.a. no appropriate, either because the course is a general course or because there is no one occupation that the course is designed to prepare students for. - could not be estimated because there were no enrolments pre-reform.

Table A6: Impacts of VTG on graduate annual earnings from courses associated with skill shortage areas, standard counterfactual trend assumptions

Constant treatment effect	-0.064***
	(0.015)
Time-varying treatment effect	
2010	-0.038
	(0.041)
2011	-0.076**
	(0.030)
Count	72,436

***Significant at 1%, **significant at 5% and *significant at 10%. Standard errors are robust-clustered at the state and territory level with critical values based on T(8-1) distribution. The results are from difference-in-difference estimation of annual earnings from the national Student Outcome Survey (SOS) VET graduate data of 16- 25 year-olds for 2005-2011. The estimated effects of the reforms on graduate earnings represent the coefficients on three-way interactions between a post-reform dummy (or post-reform year dummy), a dummy of whether the student was a graduate from a course that was associated with an occupation on the previous year's skill shortage list and dummy for the state of Victoria. All models control for socio-economic background, highest prior education, employment status prior to study, current employment status, age in years, state, region and year fixed effects, qualification level attained, gender and indigenous and disability status.

Table A7: Difference-in-differences estimates for course choice outcomes using skill demand information in 2012 that is available at the time of enrolment in 2011, standard counterfactual trend assumptions

	Unconditional		With individual controls		With individual and provider controls	
	National skill shortage	Expected earnings	National skill shortage	Expected earnings	National skill shortage	Expected earnings
Constant treatment effect	0.031***	0.026***	0.029***	0.030***	0.027**	0.030***
	(0.005)	(0.006)	(0.004)	(0.005)	(0.008)	(0.006)
Time-varying treatment effect						
2010	0.030***	0.017**	0.025***	0.018**	0.023**	0.018**
	(0.007)	(0.007)	(0.005)	(0.007)	(0.007)	(0.007)
2011	0.020**	0.022*	0.022***	0.027**	0.020*	0.028**
	(0.007)	(0.010)	(0.005)	(0.009)	(0.009)	(0.010)
2012	0.046***	0.037***	0.043***	0.041***	0.039**	0.041***
	(0.007)	(0.006)	(0.008)	(0.006)	(0.012)	(0.007)
Count	1,405,010	1,596,470	1,400,325	1,591,079	1,399,907	1,590,630

***Significant at 1%, **significant at 5% and *significant at 10%. Standard errors are robust-clustered at the state and territory level with critical values based on T(8-1) distribution.

Table A8: Results for the sensitivity analysis, 2010-2012, under alternative counterfactual trend assumptions[a] with full set of controls

	National skill shortage	Course graduate wage	Module completion	Course completion
Standard estimates (Tables 3 and 5)	0.047***	0.033***	0.026***	0.041***
	(0.013)	(0.008)	(0.007)	(0.010)
Enrolments restricted to Albury and Wodonga	0.078***	0.062***	0.068***	0.039***
local government areasa	(0.002)	(0.002)	(0.012)	(0.001)
Restrict to 18-19 year-olds	0.061*	0.033***	0.026***	0.053***
	(0.031)	(0.008)	(0.005)	(0.011)
Omit enrolments from August 2008 to December 2009	0.052***	0.064***	-	-
	(0.015)	(0.011)	-	-
Omit enrolments from July 2012	0.051***	0.041***	0.029***	0.040***
	(0.013)	(0.008)	(0.008)	(0.011)
Include college fixed effects	0.049***	0.049***		
	(0.010)	(0.008)		
Include college and provider fixed effects	-	-	0.019**	0.037***
	-	-	(0.006)	(0.007)
Excluding fee-for-service courses	0.038*	0.048***	0.034***	0.041**
	(0.018)	(0.007)	(0.007)	(0.012)
Excluding courses not linked to an occupation	-	0.032***	-	-
	-	(0.005)	-	-
Excluding expected wages with missing 4-digit cells	-	0.045***	-	-
	-	(0.008)	-	-
Wild bootstrapped standard errors	0.047***	0.033***	0.026**	0.041***
	(0.000)	(0.000)	(0.012)	(0.000)

***Significant at 1%, **significant at 5% and *significant at 10%. Unless otherwise stated, results are generated with a full set of student and college controls with state cluster-robust standard errors and critical values from T(8-1) distribution.

[a]Counterfactual outcomes in Victoria are assumed to diverge relative to the Rest of Australia at the same constant rate present prior to the reform (2006-09).[b] Local government areas (LGAs) is an Australian standard geographical classification that covers the administrative boundaries of local governments, similar to counties in the United States. The LGAs of Albury (in Victoria) and Wodonga (in NSW) are divided by the Murray River, which is the Victoria and NSW state border. This model is estimated on a sample size of 1962 and 3073 observations for national skill shortage and course graduate wage respectively. Standard errors are robust-clustered at the state level with T(2-1) critical values. [c]We use the cgmwildboot program (provided by Judson Caskey, https://sites.google.com/site/judsoncaskey/data) to estimate p-values based on wild bootsrapped standard errors clustered at the state and territory level with 1000 draws. The program produces p-values (reported in square brackets) that are based on empirical T(8-1) distribution.

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