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VET program completion rates: an evaluation of the current method

National Centre for Vocational Education Research

INFORMING POLICY AND PRACTICE
IN AUSTRALIA'S TRAINING SYSTEM

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This document should be attributed as NCVER 2016, *VET program completion rates: an evaluation of the current method,* NCVER, Adelaide.

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COVER IMAGE: GETTY IMAGES/iStock

ISBN 978 1 925173 71 0
TD/TNC 126.07

Published by NCVER, ABN 87 007 967 311

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About the research

VET program completion rates: an evaluation of the current method

National Centre for Vocational Education Research

The premise to this work is a simple question: 'how reliable is the method used by NCVER to estimate projected rates of VET program completion?' In other words, how well do early projections align with actual completion rates some years later?

Completion rates are simple to calculate with a cohort of students who start together in a very short program with a defined end date. The context in vocational education and training (VET) is, however, far more complex. Program lengths vary and may span several years, students commence at different times and many study part-time. Waiting for all students to complete or 'drop out' of their training before calculating an actual completion rate gives a reliable answer, but is somewhat impractical.

This paper summarises the key findings from a technical review of the validity of the method long used by NCVER in estimating projected completion rates for government-funded VET programs. This analysis required the interrogation of large longitudinal data sets with tens of millions of enrolments over multiple years. Whilst the work beneath it is complex, the outcomes are revealing because of ever-high interest in completion rates as measures of the efficiency and effectiveness of the VET sector.

Key findings

- The method long used by NCVER for estimating VET program completion rates using data from the National VET Provider Collection is shown to be reliable and aligns well with actual rates of completion for historical estimates. One of the advantages of the methodology is that it can be readily applied to subsets of the data based on student demographics or attributes of the training.
- Given that it takes a number of years for actual rates of completion to stabilise, the method is well suited for inclusion as part of any method of assessing completion rates, where the projected completion rate method is used to estimate rates for the most recent years and actual rates used for prior years.
- The technical review has also shown that the current predictive method can be improved by defining a program's commencing year as the year it first appears in the National VET Provider Collection rather than using the commencing flag variable.
- It is anticipated that the incorporation of unique student identifiers into any preferred methodology, and its extension to total VET activity, can be phased in from the collection of 2017 training activity.

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Contents

Tables and figures

Tables

Figures

Introduction

The Australian vocational education and training (VET) system provides training across a wide range of subject areas for students of all ages and backgrounds. The training is delivered through a variety of training institutions and enterprises (including to apprentices and trainees), and students may study individual subjects or full programs that lead to formal program completions.

This diversity presents a challenge for the VET sector in devising indicators of efficiency and effectiveness, such as VET completion rates — the focus of this paper.

There are two fundamental concepts associated with deriving completion rates. The first concerns subject-completion[1] rates, which are straightforward and are routinely published in the Productivity Commission's *Report on government services* (2016). It is simply the proportion of subjects undertaken that are successfully completed, based on hours of training.

The second, the rate at which programs or qualifications are completed, is more problematic. The difficulties arise in two areas. First, technically, it is far from straightforward because the VET system has only recently introduced a unique student identifier (USI), which can be used to track a student's training activity from commencement through to completion, and identifying the date at which a student commenced a qualification is not well defined.

The second issue concerns the interpretation of a program-completion rate, as many individuals undertake particular VET subjects with a view to obtaining particular skills rather than obtaining a complete qualification. Because some of these students are reported to the National VET Provider Collection as enrolled in qualifications, the enrolment data overestimate the actual number of qualifications being undertaken, while completion rates underestimate the number of qualifications being completed. Notwithstanding, it is readily agreed the sector needs information pertaining to the rate of program completion and a methodology with which to derive it.

In an occasional paper published by the National Centre for Vocational Education Research (NCVER) in 2012, Bednarz examined completion rates, which included an explanation of how they are defined and calculated. In terms of a definition for completion rates, Bednarz (2012, p.7) notes that:

> The most intuitive definition of a completion rate is that it is simply the proportion of students who finish the course they started. For example, if 100 students started a course in 2005, and 27 of those students went on to complete their course, we'd say that the completion rate for 2005 is 27%.

As Bednarz (2012) explains, in an ideal world we would wait for all courses to finish before calculating the actual rate of completion, noting that some courses can take several years to complete and many students undertake part-time study, both of which extend completion dates. Thus, as Bednarz (2012) explains, because 'we potentially

1 Load pass rate in the terminology of the VET sector.

have to wait many years to ensure all students have had the opportunity to complete', determination of actual completion rates can be delayed significantly, reducing the usefulness of the data (p.7).

To overcome this issue, NCVER has derived a methodology for estimating projected program completion rates. The methodology used is presented in Mark and Karmel (2010), and applies probability theory to the National VET Provider Collection data, specifically to the status of program enrolments across successive years, to derive the probability that a commencing VET program enrolment will eventually be completed.

NCVER has long published completion rates of government-funded[2] VET programs in Australia for a number of VET sub-populations using this technique, including those relating to states and territories, program level and broad fields of education. These are further sub-populated for full-time students aged 25 years and under with no prior post-school program completion.

Ongoing interest in completion rates as measures of the efficiency and effectiveness of the VET sector has prompted NCVER to undertake a review of the long-used methodology to examine its validity. This paper summarises the findings of this technical review and makes some recommendations for its improvement and the future publication of completion rates.

2 Government-funded VET is broadly defined as all programs delivered by government providers and government-funded programs delivered by community and other registered providers.

How does NCVER currently derive VET completion rates?

To explain NCVER's current approach to deriving completion rates, we again borrow from Bednarz (2012). NCVER reports completion rates at several different levels; that is, for courses, subjects, apprentices and trainees, and specific sub-groups of students. To estimate completion rates, we need to track particular components, or entities, of these, for example, courses, subjects, contracts of training, or individual students from their commencement. A group of entities that started at the same time is referred to as a 'commencing cohort'.

This paper is concerned with completion rates for VET qualifications and the methodology used to derive them. NCVER currently publishes two sets of completion rates: program completion rates and subject completion rates.

Bednarz (2012, p.7) offers a useful starting point for our definitions of *program completion rate* and *subject completion rate*, noting that the terms 'program' 'qualification' and 'course' are used interchangeably throughout this paper.

> A **program completion rate** is the proportion of VET programs started in a given year that will eventually be completed. It is also referred to as a qualification or course completion rate.

Subject completion rates

A VET program is comprised of a number of subjects, also referred to as 'modules' or 'units of competency'. NCVER also reports subject completion rates, termed 'load pass rates'. Unlike the program completion rate, the subject load pass rate needs to be weighted because subjects are of different lengths, and this needs to be accommodated. Determination of the subject completion rate is based on the annual hours (or full year training equivalent — FYTE) for each assessable module or unit of competency. A subject load pass rate is defined by Bednarz (2012, p.8) as follows:

> A **subject load pass rate** is the ratio of hours studied by students who passed their subject(s) to the total hours committed to by all students who passed, failed or withdrew from the corresponding subject(s).

How the projected rates are currently calculated

As highlighted in this paper's introduction, to calculate the true program completion rate, we need to wait for all students who started a program in a given period to either complete or drop out of the program; that is, we need to track each program from start to finish. Only when all programs are accounted for will we know the final program completion rate. Unfortunately, this can take years as some programs are scheduled for two or three years, which can take even longer if undertaken on a part-time basis.

There is a further problem: even if we wait for the programs to finish (either completed or withdrawn), completions are not always reported immediately to the National VET Provider Collection. This delay in reporting means that completions occurring in a given year or quarter might take another year or longer to be reported.

Not surprisingly, the longer we wait, the more accurate the completion rate becomes, although, as time goes by, the data become less relevant, making the information less useful for performance evaluation. While the direct approach of tracking programs from start to finish is adequate for tracking historic rates of completion, the need remains to derive projected completion rates for the most recent years.

As a result, NCVER has developed a methodology for estimating projected program completion rates using data from the National VET Provider Collection. The data used provide information on the status of program enrolments across successive years. While the National VET Provider Collection is essentially a cross-sectional database by year, it contains enough inherent information to match data across years for individual VET students and the programs they undertake. The matched longitudinal dataset obtained then allows the use of mathematical techniques that rely on conditional probabilities to calculate the anticipated rates of completion.

The current methodology, which has been used by NCVER for some time, is presented in Mark and Karmel (2010). This approach uses information about program enrolments over a three-year window (centred on the year of interest), together with the theory of absorbing Markov chains to derive the probability that a commencing VET program enrolment will eventually be completed. The advantage of Markov chain theory is that it has the property that the probability of an entity 'transitioning' from one status to another in successive time periods is not dependent on past transitions. This means we can use knowledge of the 'status' of program enrolments across successive years to predict the long-term program completion rate without having the full history of all program enrolments. Another advantage of the methodology is that it can be readily applied to subsets of the data based on student demographics or attributes of the training.

To obtain these statuses, student and program information are matched across a three-year window, centred on the year of interest. Here, the year of interest is *year n,* the year prior *year n–1* and the following year *year n+1*. The first two years of data (*years n-1* and *n*) are used to determine the status of program enrolments for the year of interest. The last two years (*years n* and *n+1*) are used to determine the status of program enrolments for the following year. Once this is done, we can cross-tabulate the status of program enrolments for the year of interest with those of the following year to calculate the proportions transitioning from one status to another and use these to determine the likelihood that any program enrolment commencing in the year of interest will eventually be completed. To illustrate this process in more detail, a working example is presented in the appendix.

How accurate are the current estimates of completion rates?

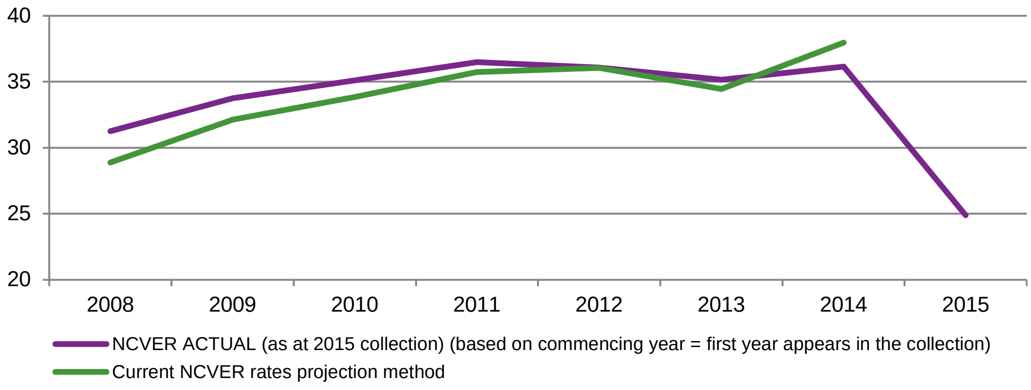
The title of this chapter asks a very important question but it is by no means an easy one to answer, as it requires tracking every student enrolment from start to finish. While there is enough information to match data across years, a number of inherent data issues limit the accuracy of the tracking process. Foremost amongst these is the fact that NCVER does not have the actual names and addresses of students but an encrypted identifier. This means we cannot be 100% certain we are following the same student over time. For example, if a student gets married and changes their name, they will get a different encrypted ID based on their new name. Also, if a student starts a course with one training provider and completes it with another, relating this activity to the same individual may not be possible. It is anticipated that the recent introduction of the unique student identifier (USI) will overcome this issue, although it will take some years before all program enrolments in the system will have an associated USI. Additional complications arise due to the lack of reliable information on the actual start date of the program enrolment, an issue discussed further in the next chapter.

Notwithstanding these inherent data issues, it is possible to assess the accuracy of the completion rates derived using the Mark and Karmel (2010) method, by matching, as best we can, student program enrolment information across the collection years from commencement to completion.

By taking the year in which a program enrolment first appears as a pseudo starting year and matching records across collection years by unique encrypted ID, sex, date of birth and course identifier, we can derive estimates of actual qualification completion rates for enrolments flagged as commencing in a particular year.[3]

The derived 'actual' rates of completion are shown in figure 1, together with the latest projected rates based on the Mark and Karmel (2010) method.

Figure 1 Comparison of current projected and actual program completion rates, 2008–15 (%)



Source: National VET Provider Collection, 2015.

3 As some encrypted IDs have multiple client IDs connected to them, the 'actual' rates have been based on unique NCVER encrypted IDs comprising only a single client identifier.

Two things stand out immediately in the graph above. First, the actuals 'fall away' from the projected estimates in the most recent years. This reflects the upwards revision in the rates that occurs once additional award records become available in subsequent collections. The second observation is that the projected rates of completion produced by the Mark and Karmel (2010) method are remarkably similar to those of the actual rates. Notwithstanding, there is some evidence that the Mark and Karmel method has historically understated historical rates. While the discrepancy is not large, it suggests some refinements to the existing methodology may be warranted.

Reviewing the methodology

As with any projection methodology, ongoing evaluation is crucial to understanding and taking account of changes in the underlying data. The previous chapter highlighted that the Mark and Karmel methodology appears to reasonably project the rates of completion, although there is some evidence it may be regularly understating the true rates. This prompted NCVER to undertake a review of the approach and its assumptions.

Several areas were investigated, including alternative modelling techniques, the criteria developed by Mark and Karmel (2010) for classifying an enrolment's Markov chain state, and the quality of the data elements in the National VET Provider Collection. Rather than detail all these analyses, findings and the issues potentially requiring consideration in the future, we restrict our attention to the issues requiring immediate attention.

One of the key concerns uncovered by the review relates to the definition of a program commencement and its starting date. Under the Australian Vocational Education and Training Management Information Statistical Standard (AVETMISS), training providers are required to supply a Commencing program identifier. This field is meant to indicate whether a student enrolled in a qualification, course or skill set for the first time with the training organisation in the collection year. Unfortunately, this field is open to interpretation by training providers and is difficult to validate. Table 1 highlights this issue, showing that around 10—15% of program enrolments with a commencing flag of 'Y(es)' in a given year also have a commencing flag of 'Y(es)' for the previous year, or the following year, or both.

Table 1 Breakdown of where commencing flag = 'Y(es)' within three-year matched datasets centred around years of interest (% of total)

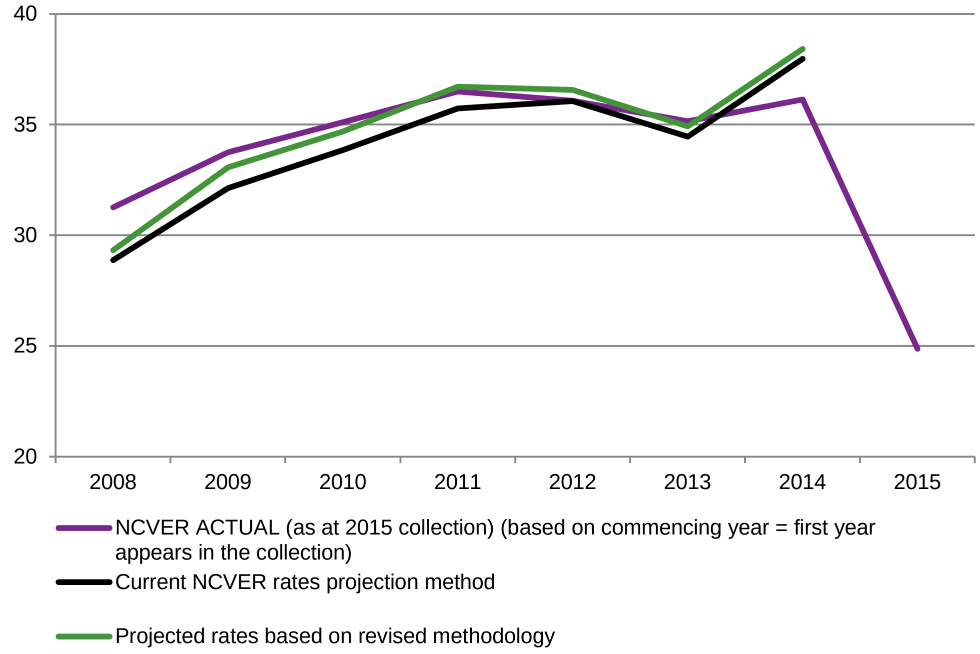
Year of interest: 2012		Year of interest: 2013	
'Y' in 2012 only	85.3	'Y' in 2013 only	87.6
'Y' in 2011 and 2012	6.0	'Y' in 2012 and 2013	8.1
'Y' in 2012 and 2013	7.6	'Y' in 2013 and 2014	3.7
'Y' in all 3 years: 2011–13	1.1	'Y' in all 3 years: 2012–14	0.6
Total	**100.0**	**Total**	**100.0**
Number of enrolments with commencing flag of 'Y(es)' between 2011 and 2013	*1 522 871*	*Number of enrolments with commencing flag of 'Y(es)' between 2012 and 2014*	*1 517 457*

Source: National VET Provider Collection, 2015.

In their paper, Mark and Karmel (2010) define a commencing year according to two criteria: if the VET program is enrolled in *year n* and the commencing flag variable states it is a commencing year (that is, commencing flag is 'Y'[es]). Based on the evidence above, it can be assumed that many programs are being incorrectly classified as a commencing course using the Mark and Karmel (2010) method when in fact they may be continuing, or possibly even completed. For example, of the 1 517 457 program commencements between 2012 and 2014, 8.1% were flagged as commencing in both 2012 and 2013 (table 1).

Rather than use the commencing flag variable, an obvious alternative is to define the year of commencement as the year a program first appears in the National VET Provider Collection. An analysis was undertaken to compare the projected rates of completion against the derived actual values, with projections based on: (a) the existing Mark and Karmel (2010) method utilising the collection's inherent commencing flag; and (b) the utilisation of the new commencing year derived from the earliest year in which a program enrolment appears in the collection. The results are presented in figure 2.

Figure 2 Comparison of projected program completion rates (current and revised) against actual rates of completions, 2008–15 (%)



Source: National VET Provider Collection, 2015.

Again, the graph highlights the dramatic 'falling away' of the actual completion rates from the projected rates in the most recent couple of years, reflecting the upwards revision of the rates that occurs with subsequent collections. With respect to the projected rates, the graph highlights an apparent increase in accuracy of the rates via the revised methodology, which incorporates the new approach for defining the commencing year, as evidenced by this projected series more closely aligning with the actual series for 2013 and prior years.

We can test this hypothesis statistically through the Mean Squared error (MSE) and Mean Absolute error (MAE), both of which are valid statistical measures for determining how close a set of projections or predictions is to the eventual outcomes. They are defined as:

$$\text{MAE} = \frac{1}{n}\sum_{i=1}^{n} |f_i - y_i|$$

$$\text{MSE} = \frac{1}{n}\sum_{i=1}^{n} (f_i - y_i)^2$$

where f_i is the projected completion rate and y_i the actual value for year i. The closer the values are to zero, the closer the projections are to the actual values overall.

The resulting MSEs and MAEs, based on the projections for years 2008 through 2013, are shown in table 2 and support the hypothesis that the revised method performs better in projecting the actual rates of completion.

Table 2 Comparison of Mean Absolute and Mean Squared errors based on projected completion rates estimated using the current and revised approach, 2008–13

Method	MAE	MSE
Revised method incorporating new approach for defining the commencement year	0.66	0.74
Current Mark and Karmel (2010) method using commencing flag	1.12	1.73

It is well recognised that the number of program completions, and therefore the rates of completion, take some time to stablise. This is highlighted in table 3, which shows that it takes in the order of four years after commencement for completion rates to reach some sort of equilibrium (that is, where the change in actual completion rate becomes negligible by comparison with subsequent data collections). It therefore seems logical to publish rates of completion for the most recent three years according to the revised projected completion rate methodology outlined above and the actual rates for prior years.

Table 3 Actual rates of completion by collection year (%)

	Year of completion rate								
Collection year	2007	2008	2009	2010	2011	2012	2013	2014	2015
2007	14.6								
2008	23.8	14.9							
2009	27.7	25.5	17.5						
2010	29.5	28.8	28.3	18.2					
2011	30.2	30.5	31.7	29.4	19.3				
2012	30.3	31.1	33.3	33.5	32.5	22.1			
2013	30.4	31.2	33.6	34.7	35.2	33.0	20.7		
2014	30.4	31.3	33.7	35.0	36.2	35.3	32.3	23.4	
2015	30.4	31.3	33.8	35.1	36.5	36.1	35.2	36.1	24.9

The potential also exists for improvement in the accuracy of the projections through submission of updated and/or missing information to subsequent collections of the National VET Provider Collection. Some completion records miss the cut-off date for reporting in a collection and may not be reported in subsequent collections. Unfortunately, it is not possible for NCVER to quantify the impact of this issue at this time. Actual and projected program completion rates may be being underestimated across all levels, an issue that requires further investigation.

Although the unique student identifier has only recently been introduced, it is expected to make the process of observing and tracking program enrolments from commencement to completion easier and more reliable. As the Markov chain approach requires a minimum of three years data to estimate projected completion rates, the application of USIs into the methodology will be phased in from the 2017 collection. The incorporation of USIs into the methodology used to estimate program completion rates will require due investigation to understand its impact before implementation.

Further investigation is also required to confirm the adequacy of the Markov chain methodology to project rates of completion for total VET activity, first collected with a number of exemptions in 2014 and more fully for 2015. It is anticipated that the methodology can be readily applied to TVA; however, similar to the incorporation of the USI noted above, a minimum of three years of comparable data is required, meaning that any TVA projections based on this methodology would not become fully available until after the collection of 2017 training activity.

Another area warranting investigation concerns superseded qualifications (that is, when a program is replaced or incorporated into a new one) and their potential impact on completion rates. A very initial analysis at the national level indicated rates of completion may increase by as much as two percentage points once superseded qualifications are taken into account in a longitudinal analysis of program enrolments.

In general, the criteria developed by Mark and Karmel (2010) for classifying an enrolment's Markov chain state was found to be adequate for the purposes of projecting actual rates of completion. While a number of alternative ways to classify program enrolments into initial Markov chain states were considered, none appears to work more effectively in terms of more closely approaching the actual rates.

The possibility of using other statistical techniques was also considered. Methods such as non-linear regression and mixed modelling are valid alternatives to the Markov chain approach; however, there are some significant downfalls in their application. In particular, these methods assume that the historic nature of the data continues into the future, and that they are not intrinsically adaptive in their approach to projecting the future. This is where the conditional probability Markov chain method offers the advantage: being a random sequential and adaptive process, any change in the underlying trend will quickly be reflected in the transitional probabilities the Markov chain approach uses.

Conclusion

In this paper, we reviewed the validity of the method used by NCVER for some time to estimate completion rates for government-funded vocational education and training programs.

Our findings show that this approach, whereby data from the National VET Provider Collection are utilised, is reliable and aligns well with the actual rates of completion. The divergence of data for the most recent years reflects the upwards revision in the rates that occurs once additional award records become available, in subsequent collections. The current methodology has the advantage that it can be readily applied to subsets of the data based on student demographics or attributes of the training.

One of the key issues identified during the review concerns the definition of a program commencement and its starting date. The current methodology uses the commencing flag variable, which this analysis has shown is problematic, in that it understates projected completion rates. Defining a program's commencing year as the year it first appears in the National VET Provider Collection increases the accuracy of the projected rates, with these rates aligning more closely with actuals for all but the most recent years, for the reasons described above.

Given that it takes a number of years for actual rates of completion to stabilise, the method is well suited for inclusion as part of any method of assessing completion rates, where the projected completion rate method is used to estimate rates for the most recent years and actual rates used for previous years.

Further improvements to the rates may also be possible, for example, by investigating the effect of superseded qualifications to determine what other refinements could be made to improve accuracy. Due investigation will also be required to fully understand the impact of incorporating USIs into the methodology. As the method requires a minimum of three years data, the addition of USIs into the methodology cannot be phased in until data for 2017 training activity have been collected.

Investigation is also required to check the adequacy of applying the methodology to total VET activity. With 2015 being the first year of TVA collection without exemptions, along with the methodology requiring three years of comparable data, projections for TVA rates of completions would not become fully available until after the collection of 2017 training activity.

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Appendix

The current method for projecting rates of completion: a working example

At the time of writing this paper, the latest National VET Provider Collection was 2015. As we require information for *both* the year of interest and the year following the year of interest, the latest year for which we can predict program completion rates is 2014.

The first step in the process is to create a matched dataset of program enrolments; this is undertaken by matching students and the programs they enrolled in across the three years, 2013 to 2015. This process is well explained in Mark and Karmel (2010), and essentially entails using information in the National VET Provider Collection pertaining to the student and the unique programs in which they enrol to match unique program enrolments and completions (awards) across the three years, 2013 to 2015.

Table A1 details the breakdown of the 4 555 365 unique student program enrolments in the 2013 to 2015 matched dataset.[4]

Table A1 Breakdown of student program enrolments within the three-year matched dataset centred around 2014

Program enrolments in 2013		Program enrolments in 2014		Program enrolments in 2015	
In 2013 only	1 470 338	In 2013 but not 2015	390 467	In 2013 but not 2014	9 133
In 2014 but not 2015	390 467	In 2014 only	983 608	In 2014 but not 2013	354 890
In 2015 but not 2014	9 133	In 2015 but not 2013	354 890	In 2015 only	1 098 673
In all 3 years	96 578	In all 3 years	96 578	In all 3 years	96 578
Total	**1 966 516**	**Total**	**1 825 543**	**Total**	**1 559 274**
Total records in matched dataset	**4 555 365**	**Total records in matched dataset**	**4 555 365**	**Total records in matched dataset**	**4 555 365**

Source: National VET Provider Collection, 2015.

The next step of the process is to determine the status of these program enrolments in the year of interest (2014) and the following year (2015). Based on the approach outlined by Mark and Karmel (2010), this involves classifying each VET program enrolment in any one-year period as being in one of four states:

- commencing program year
- continuing program year
- dropped out of the program (discontinued)
- completed the program.

Here, a VET program enrolment can only be classified to one state in each year. Thus a program commenced in 2014, say, is counted as a commencing program in 2014 even if the program is also completed in that same year. Such a program will be classified as completed in the following year, in 2015. Further, the VET program enrolment's course

4 In terms of the matched datasets, a program enrolment associated with a given year means a program enrolment record exists within the VET Provider Collection for that year.

is assumed to be a discrete-time random (stochastic) process, meaning that the year-to-year transition in an enrolment's status only depends on the last status the enrolment occupied, and is independent of its past. Furthermore, the last two states ('dropped out' and 'completed') are assumed to be absorbing states, since, in theory, a program that has been completed or been dropped out of will always remain that way.

Finally, some of the program enrolments in our matched dataset will not fall into any of the four states listed above for a particular year of interest, either because they have not yet commenced, have already been completed, or already dropped out of. To account for these, a dummy status of 'Not in the system' is assigned.

The method for classifying the status of a program enrolment is presented in Mark and Karmel's (2010) paper. Based on this approach, and applying it to the data in our 2014 matched longitudinal dataset (centred around 2014 as our year of interest), we derive the program enrolment statuses for 2014 and also their transitioning statuses for 2015, as shown in table A2.

Table A2 2014 program enrolment status and their transitioning 2015 equivalents (number)

	2015 Status					
2014 Status	Completed (1)	Dropped out (2)	Continuing (3)	Commencing (4)	Not in the VET system	Total
Completed (1)	45 163	5 721	764	510	557 915	610 073
Dropped out (2)	378	0	3 929	4 320	958 652	967 279
Continuing (3)	202 604	242 108	127 155	0	0	571 867
Commencing (4)	328 315	599 986	319 278	0	0	1 247 579
Not in the system	13 045	0	87 184	1 011 026	47 312	1 158 567
Total	**589 505**	**847 815**	**538 310**	**1 015 856**	**1 563 879**	**4 555 365**

Source: National VET Provider Collection, 2015.

A couple things become immediately obvious: first, the states 'completed' and 'dropped out' are not completely 'absorbing', with several program enrolments moving from a completed state in 2014 to either a continuing (764) or commencing (510) state in 2015. The numbers are small however and can be ignored. Second, there are a number of enrolments deemed not in the system in 2014 transitioning to either a continuing (87 184) or completing (13 045) state in 2015. This reflects the flexibility in the sector, whereby students can undertake their program part-time and not enrol in successive years.

As our interest is in the proportion of program enrolments within a defined state in 2014 'transitioning' to another state in 2015, we need to consider the corresponding row percentages, as provided in table A3.

Table A3 Proportion of 2014 program enrolments transitioning to 2015 statuses

2014 Status	2015 Status: Completed (1)	Dropped out (2)	Continuing (3)	Commencing (4)	Not in the VET system	Total
Completed (1)	7.40	0.94	0.31	0.08	91.45	100%
Dropped out (2)	0.04	0.00	0.14	0.45	99.11	100%
Continuing (3)	35.43	42.34	22.24	0.00	0.00	100%
Commencing (4)	26.32	48.09	25.59	0.00	0.00	100%
Not in the system	1.13	0.00	7.53	87.27	4.08	100%

It is these 'row' proportions ($p_{\text{row,column}}$) that are used to derive the conditional probability that any VET program enrolment commencing in 2014 will eventually be completed.

This can be calculated by applying absorbsing Markov chain theory via the following formula:

$$\Pr(\text{eventually completing program}) = p_{41} + p_{43}\frac{p_{31}}{p_{31}+p_{32}}\,.$$

Where

p_{41} = the proportion of program enrolments deemed to commence in 2014 and completed in 2015 (i.e. row 4, column 1)

p_{43} = the proportion of program enrolments deemed to commence in 2014 and continuing in 2015 (i.e. row 4, column 3)

p_{31} = the proportion of program enrolments deemed to be continuing in 2014 and completed in 2015 (i.e. row 3, column 1)

p_{32} = the proportion of program enrolments deemed to be continuing in 2014 and dropped out in 2015 (i.e. row 3, column 2).

Thus, in terms of table A3, we have:

P41 = 26.32

P43 = 25.59

P31 = 35.43

p32 = 42.34

Applying these values to the formula above results in the overall probability of a VET program enrolment commenced in 2014 eventually being completed of 38%.

It is this probability that is taken as the projected completion rate for program enrolments commencing in 2014.

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