University Location and City Development:

The Effects of Victoria University on the

Western Melbourne Economy

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Abstract

Does the presence of a local university affect the economic development of an area within a large city? This paper focuses on the Western region of Melbourne, which accounts for 18 per cent of the city's population of 4.5 million. Only one of Melbourne's seven universities has located campuses in Western Melbourne, a region containing many areas of social disadvantage. The importance of the University to the region's economy in 2013 is analysed with the aid of a 6-region CGE model, four of the regions covering Greater Melbourne. The analysis is undertaken by simulating a counterfactual that there was no university in the region during the period 1992 to 2013. Under the counterfactual, students who in actuality had studied in Western Melbourne in the period are assumed to have either attended a university in another Melbourne region or forgone a university education. The simulation accounted for a relocation of both the University's demand-side impacts (operating expenditures and student living costs) and its supply-side impacts (knowledge effects). A particular feature of the analysis was the estimation of the interregional relocation of local productivity effects flowing in 2013 from returns to the stocks of human capital and research knowledge accumulated over the years from 1992. For the human capital effects this involved, for each Melbourne region, undertaking detailed estimates of changes in annual university completions, annual migration rates, labour force participation rates, interregional commuting and returns to university qualifications. Key assumptions related to the effects of university proximity on tertiary participation and of place of study on regional attachment. For local R&D effects, regional estimates were made of annual R&D expenditure, knowledge decay, returns to R&D expenditure and regional knowledge spillovers. The simulation results suggested that the presence of a university in Western Melbourne had a significant effect on the region's GDP, but due to interregional commuting the local university had a more muted effect on the real consumption of the region's households.

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1 Introduction[1]

Victoria University (VU) has a long history of engagement with the Western Melbourne region in creating opportunities for students from this area and in establishing strong links with the region's industry and community. As part of framing its 2016-2020 West of Melbourne Strategy VU requested an economic modelling study of the effects that the University's focus on Western Melbourne is having on the region's economy.

The whole study consists of two main components: (1) an analysis of the current significance of the University to the Western Melbourne economy; and (2) an analysis of the economic effects on Western Melbourne of VU generating an increase in tertiary participation (and retention) in the region. In this report, we address the first of these components.[2]

The major vehicle of the numerical analysis is a multiregional computable general equilibrium (CGE) model of the Australian economy, TERM. A version of TERM was developed, with a regional and sectoral structure specially tailored for the current study. The TERM model is outlined in the next section (Section 2), together with an overview of the overall approach to the CGE study.

2 Study Method
2.1 *The Economic Model: TERM-WM*

For the purposes of this study a customized version of TERM is developed. This version of the model (hereafter referred to as TERM-WM) separately identify six regions: (1) Western Melbourne; (2) Inner Melbourne; (3) Outer South-East Melbourne; (4) Rest of Melbourne; (5) Rest of Victoria; and (6) Rest of Australia.[3] TERM-WM contains 22 industries in each of the six regions. The industries are the standard 19 ANZSIC industry divisions with the exception of the disaggregation of ANZSIC Division P, Education and Training, into three individual education industries (Higher Education, Technical & Vocational Education, and Schools & Other Education), and the addition of an Ownership of Dwellings industry (as is standard for inter-industry analysis).[4] The theory of the model was amended to introduce a distinction between place of work and place of residence along the lines developed by Madden and Gwee (2010). This amendment is important for capturing the regional spending patterns of students and university staff that commute interregionally.

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[1] This working paper first appeared as a report to the Office of the Vice-Chancellor, Victoria University, in April 2016. The report's findings were publicly released by the Vice-Chancellor at VU's Centenary Gala Dinner on 21 May 2016.

[2] Preliminary results for the second component were presented to the Melbourne Economic Forum in October 2016 (J. Madden, 'University location and city development: the case of Western Melbourne', presentation to Melbourne Economic Forum on *Work and life in cities: city strategy in Australia*, Victoria University, Melbourne, 27 October, 2016.)

[3] See Table A1 in Appendix A for definitions of the four Melbourne regions.

[4] In terms of the ANZSIC classification, these are: Class 8102 (Higher Education), Class 8101 (Technical and Vocational Education and Training), and Subdivisions 80 (Preschool and School Education) and 82 (Adult, Community and Other Education).

TERM's theoretical and data structures are well documented in Horridge et al. (2005), Wittwer and Horridge (2010) and Horridge (2012). TERM explicitly captures the behaviour of industries, households, investors, government and exporters at the regional level. The core of its theoretical structure follows a standard CGE pattern. Producers in each region are assumed to minimize production costs subject to a production technology that allows substitution between primary factors (labour, capital and land) and between geographical sources of supply for specific intermediate inputs. Demand for effective inputs of labour to each regional industry is defined over labour distinguished by occupation. A representative household in each region purchases goods and services in order to maximize utility subject to a budget constraint. Investors seek to maximize their rate of return, while demand by foreigners is modelled via export demand functions that capture the responsiveness of foreigners to changes in export supply prices. Each region is linked via trade and interregional labour flows.

2.2   *Introducing interregional commuting into TERM-WM*

The TERM model was designed to allow the modelling of many regions and industries. For example, its first version contained 38 industries and 45 regions, and was used to analyze the Australian drought of 2002-03 (Horridge et al., 2005). The regions for this and many TERM studies are ABS statistical divisions or combinations of statistical divisions (SDs).[5] There are 58 SDs covering Australia, but each Australian capital city comprises only one SD. This means that, in general, it has been safe to assume that there is a limited degree of commuting between regions, and that workers spend their income largely in the region in which they work. However, in TERM-WM there are four regions located within the Melbourne SD and ABS journey-to-work data confirms what is clear from observation, that there is a considerable degree of commuting between these TERM-WM regions.

It was therefore necessary in creating TERM-WM to take interregional commuting into account. This required changes to both the method of forming the model's interregional data base and to the model's theory.

The major task in creating a TERM data base is to turn the national input-output (I/O) table into a multiregional I/O table. This requires splitting each industry into separate regional locations, splitting final demands into purchaser locations, and estimation of how each region sources its purchases of each commodity across regions. This is done by a computer program employing a method devised by CoPS' Mark Horridge (see Horridge et al., 2005). The method involves a series of complex estimation procedures, but for the purposes of this report we note that at the heart of the Horridge method is the use of location quotients and the

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[5] See ABS (2002) for definitions of Australian spatial areas. From 2011 the ABS has started to use a new geographical classification. We use the 2002 definitions since they align with local government areas (LGAs) and this suits our purpose here as Western Melbourne is a combination of LGAs. In this study we make extensive use of population census data. The 2011 Census data is provided on the basis of the 2002 classification (as well as the 2011 classification) and this allows us to use a geographical classification which is common to all censuses from 1991 to 2011.

gravity method.[6] The location quotients (essentially regional shares in nationwide output of an industry) are usually formed on the basis of industry employment by region data from the ABS labour force survey. The survey, which involves a multi-stage area sample of dwellings, does not distinguish place of work from place of residence.

For TERM-WM we need separate figures for place of work and place of residence. The required data are available from the 2011 Census of Population and Housing. The ABS' TableBuilder facility was used to create a matrix of place (LGA) of work by industry by place (LGA) of residence, for the 19-industry ANZSIC industries and for 4-digit education industries.[7] This data was then reformatted into TERM-WM region and industry dimensions. The program for estimating the TERM-WM multiregional I/O data base was then adjusted so that place-of-employment by industry figures were used in estimating regional shares in nationwide output for each industry, while the place of residence figures were used to determine regional shares in household consumption.

The TERM-WM theory also needed to be amended to recognize that households could earn their labour income from employment in industries outside of the region in which they worked. The standard equation for the percentage change in region r's wage income was replaced by the following equation:

$$winc^r = \sum_i \sum_t \left\{ \left(JTW_{i,t}^r \Big/ \sum_j \sum_s JTW_{j,s}^r \right) \times wlab_i^t \right\}$$

where $winc^r$ is the percentage change in wage income earned by region r residents, $JTW_{i,t}^r$ is the number of region r residents who are employed in industry i in region t, and $wlab_i^t$ is the percentage change in wage earnings from industry i in region t.[8]

2.3 Approach to Modelling VU scenarios

2.3.1 Introduction

Universities have a range of effects on the regional economies in which they are located.[9] The first of these effects relates to a university's operations pulling resources into a region as a result of their locating their activities in that particular region. Such local economic impacts

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[6] For a brief summary of the Horridge method for estimating an interregional data base, see Giesecke and Madden (2013), pages 433-434.

[7] LGA stands for Local Government Area.

[8] See Table A2 of Appendix A for journey to work matrices for region of employment by region of residence for both the aggregated industries case and the Higher Education industry case.

[9] There is an extensive literature on the benefits of universities to their local economies (see, for instance, Florax, 1992, Feldman and Desrochers, 2003, Drucker and Goldstein, 2007, Fritsch and Slavtchev, 2007, Dalziel et al., 2009, and Harris et al., 2011). We confine ourselves in this report to only economic effects. Universities can also have non-market benefits, both of a private and public nature, but we do not deal with those in this study. See McMahon (2009) for a discussion of non-market benefits.

differ little from the effect of other types of industries locating in a particular region.[10] However, universities due to the nature of their output – primarily teaching and research – have an effect on the community's knowledge base, and thus act to raise productivity, both in the university's own region and in other regions to which the new knowledge spills over.

There have been numerous regional economic impact studies of particular universities, mainly using input-output models which capture the multiplier effects of university expenditure in the region (see Florax, 1992, for a literature review, and Giesecke and Madden, 2006, for more recent references). Studies of the knowledge effects of universities have been largely by way of econometric studies (see, Florax, 1992, and Henderson, 2007).

Giesecke and Madden (2006) bring together these two approaches within a single methodologic framework. They employ a CGE model to examine the impacts of a university on a regional economy taking into account both local expenditure impacts (or, as they refer to it, demand-side effects) and knowledge impacts (or supply-side effects). Their general approach is adopted for the current study.

In the next two sections we discuss this study's approach to modelling the contribution that VU's Western Melbourne campuses make to the economy. The major innovations in the present study relate to the local area under examination. Giesecke and Madden (2006) analysed the economic effects of the University of Tasmania which is the only university within its state, while subsequent regional CGE studies of higher education by Hermannsson et al. (2014) and Madden (2014) model all universities in aggregate in regions (Scotland and Queensland respectively) where cross-border commuting is limited.[11] Here we examine the economic effects of VU's Western Melbourne campuses. While VU is the only university in Western Melbourne it faces competition from seven other universities located within Melbourne, and from other tertiary institutions offering vocational education and training (VET) courses throughout Melbourne, including Western Melbourne. The regional structure of the TERM-WM model, *inter alia*, captures competitive tertiary institutions located in regions outside Western Melbourne.

2.3.2   The economic contribution of VU's Western Melbourne campuses

The economic contribution study is carried out for the year 2013, the data base year of the TERM-WM model. We adopt the following interpretation of the economic contribution to the Western Melbourne economy as being the difference between the Western Melbourne economy as it was in 2013 and what it would have been like if VU had not located campuses in the region. It is assumed that if VU had not located any campuses in the region, no other university would have located campuses in Western Melbourne either. We consider two

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[10] Different industries can have varying regional economic impacts due to the composition and geographical sourcing of their inputs. A characteristic of the education industry is that, like certain other service industries (e.g. those operating tourist attractions, and sports and other events), it attracts out-of-region visitors who increase local demand. This attribute is dealt with in Section 3.1.2.

[11] Madden (2014) models the effects of an increase in participation in Queensland's universities in a similar manner to Giesecke and Madden (2006). Hermannsson et al. (2014) also adopt a similar approach, but only for the supply-side, in their CGE modelling of the effects of more graduates in the Scottish labour market.

alternative assumptions regarding how students who attended VU Western Melbourne campuses over the 1992 to 2013 period might have behaved under the hypothetical (or counterfactual) situation of VU having had no campuses in the region. Under the first alternative (our primary scenario), it is assumed that all of the students would have studied at other campuses in other Melbourne regions. Under the second alternative, we assume that not all students would have studied in a tertiary institution in another Melbourne region, but that a portion would instead have been in the workforce for the length of the "forgone" course. In Section 4 on simulation assumptions, we discuss the numerical decrease in tertiary participation modelled under the alternate scenario.

Prior to undertaking the simulations to assess the economic effects of VU's Western Melbourne campuses it is necessary first to ascertain the following direct effects:

1) All expenditures made by VU Western Melbourne campuses

2) All expenditure by other agents located in Western Melbourne that are directly induced by VU having campuses in the region

3) The effects on labour productivity in Western Melbourne industries through the extra human capital embodied in graduates who studied at VU campuses in the region

4) The effects on Western Melbourne industry productivity which has arisen as a result of VU research and development activities at its Western Melbourne campuses.

In Sections 3.1 and 3.2 we discuss our estimation of these direct effects.

2.3.3   Effects of increasing participation and retention at VU

While this report deals with the current economic contribution to Western Melbourne of VU locating campuses in the region, a future report will describe subsequent modelling of the economic impact on Western Melbourne if VU were to initiate successful strategies to raise tertiary participation and retention in the region.

3   Estimating the Direct Effects of VU

3.1   Demand-side effects

3.1.1   Demand for education services from VU's Western Melbourne campuses

In developing the TERM-WM multiregional I/O data base we generated a cost and sales structure for the two tertiary industries, Higher education and Technical and vocational education and training, in each of the six regions of the model. The multiregional data base estimation procedure assumed that both of these industries employed identical technologies in each industry and that the regional pattern of output followed that of employment (i.e. identical employment/output ratios).[12]

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[12] That is, the two tertiary industries have identical patterns of produced and primary inputs, but can have different geographical sourcing of their produced inputs.

The base data for the TERM-WM is for 2013. We are able to check cost data for the two tertiary industries in Western Melbourne from information in VU (2014) which provides financial data for 2013 decomposed into higher education and VET activities. An alternative data source for estimating the cost and sales structure of VU which was also consulted was information on the financial performance of each Category A, Higher Education Provider (HEP) in Department of Education (2014) which provides financial data for each of Australia's public universities. [13] In undertaking these checks we assigned activities to Western Melbourne campuses on the basis of: internal VU information on staff location by site; VU's 2013 Annual Report data on student numbers at on-shore campuses and geographical revenue data; and other VU information. [14]

It should be noted that the Department of Education (DoE) statistics cover both VU's higher education and VET finances in their higher education provider figures. This is in line with ABS industry statistics which assign dual sector universities to their primary activity of higher education. In the industry results provided later in this report, VU falls to the Higher Education industry. However, in discussing the estimation of the direct impacts of VU's Western Melbourne campuses in the following sections, we undertake separate estimates for the University's higher education and VET students in order to capture differences in various student characteristics between the two groups (e.g. full-time/part-time ratios, rates of completion, campus location patterns, living costs and returns to qualifications).

3.1.2 Expenditures Associated with VU and other Victorian University operations

3.1.2.1 Student living expenses

Fees represent only part of the cost of a student attending a university. In modelling the impacts of VU's Western Melbourne campuses it is necessary to take these other costs into account to the extent that they imply extra demand generated in Western Melbourne. In the case of permanent Western Melbourne residents, their attendance at a Western Melbourne campus is unlikely to have any material effect on expenditure in the region. Students from other regions in Melbourne are assumed (in line with the TERM-WM assumption for household expenditure) to undertake their expenditure in the region in which they reside. We do, however, make an estimate for a small amount of expenditure in Western Melbourne by students from other Melbourne regions enrolled at a VU Western Melbourne campus to capture on-campus and en route expenditure.

In the case of students whose permanent home is out-of-state, their living expenses while attending VU Western Melbourne campuses boosts the demand for Western Melbourne's

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[13] The relevant Department of Education (2014) data items used in our check were from: Table 1 - Adjusted Statement of Financial Performance of each HEP, and Table 5 - Adjusted Statement of Cash Flows for each HEP.

[14] Geographical revenue data (see page 100 of Victoria University, 2013) was used to disaggregate revenues between on-shore and off-shore campuses since revenue per student varied between the two. VETIS revenue was obtained from internal VU sources.

interstate and overseas exports.[15] Similarly, many Victorian students from outside Western Melbourne are likely to reside temporarily in Western Melbourne during semester. We therefore need to take account of this extra demand in the modelling.

There are two main tasks in estimating the increased expenditure in Western Melbourne resulting from student living costs. The first is to estimate the living costs of each class of out-of-region student (overseas permanent resident, interstate permanent resident, Victorian non-Melbourne permanent resident) by TERM-WM commodity class.[16] The second task is to estimate the number of students in each category.

Tourism Research Australia undertakes a quarterly survey of international visitors to Australia and publishes estimates of average expenditure by item by main purpose of journey, including education. For the year to June 2013, the average expenditure - including education fees, but excluding package tours and pre-paid international airfares - was reported as $16,280 (TRA, 2013a). Excluding education fees of $7,377, this amounted to $8,903 per education visitor. With education visitors spending on average 142 nights in Australia, this is equivalent to $62.70 per day.[17] TRA, however, does not provide a decomposition into student classes of education visitors who include non-tertiary students (e.g. secondary students aged 15 years and over).[18] The living cost figure implied by the TRA average expenditure seems much too low for tertiary students. It is considerably below other estimates of international tertiary student living costs. For instance, HSBC estimated on the basis of a worldwide survey that the annual living costs for an international student studying in an Australian mainland city was $US18,012 (approximately $AU 19,000 for 2013).[19] Australian universities web sites (including VU's) provide advice on living costs that imply similar living costs for full time students or higher. Giesecke (2005) estimates, on the basis of a 1997 AEIF[20] survey, that international students' living costs in 2004 were $20,161 ($25,313 in 2013 prices).

For the purpose of the TERM-WM simulation, it was necessary to decompose student living costs into TERM-WM commodities. This was done primarily on the basis of data from a University of Queensland Social Research Centre (UQSRC) survey of international student's spending in Australia reported in Western et al. (2005), which decomposes expenditure into 16 commodity classes, for different education sectors and for the different states.[21] Converting

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[15] While out-of-state students may spend an extended period in Victoria, they are still regarded as visitors, and therefore their expenditure is treated as an export from Victoria.

[16] We also divide students into Higher Education and VET.

[17] TRA (2013a) report that 359,481 education students spent 51 million nights in Australia in the 12 months to 30 June 2012. This yields an average of 142 nights in Australia per visit.

[18] Western et al. (2005) find that the weekly living costs of secondary school students and ELICOS students are around 70 per cent and 65 per cent respectively of higher education students' weekly living costs.

[19] The survey was carried out December 2013 – January 2014. See HSBC News item, "Australia the most expensive country for education, HSBC report". www.about.hsbc.com.au/news-and-media/australia-the-most-expensive-country-for-education-hsbc-report.

[20] See AEIF (1998).

[21] Western et al. (2005) provides average weekly expenditure results from the UQSRC survey of international students by the following classifications: 16 commodities by 8 states and territories; 16 commodities by 5

Western, et al. (2005) weekly spending estimates for international higher education students in Australia on to an annual basis, and excluding overseas and interstate travel, implies an average living cost for a full-time student in 2013 prices of $25,832, similar to the estimate by Giesecke (2005).[22] Western et al. (2005) results indicate that international higher education students living costs are 12 per cent higher in Victoria. We increase our estimate for VU student living costs to reflect this.

Annual average living costs for VET international students are treated in the same manner, on the basis of the UQSRC survey data for VET students. This yielded an average annual living cost for international full-time VET students of $23,108 for those students engaged in courses for a full academic year.

In line with Giesecke (2005) we assume that interstate student living costs are 80 per cent of those for overseas students. For out-of-Melbourne Victorian students we assume that student living costs are only 50 per cent of those for overseas students, reflecting the likelihood that a proportion of Rest of Victoria students may have permanent residences within weekly, or daily, commuting distance of VU's Western Melbourne campuses (e.g. those living near the Western Melbourne boundary in the neighbouring statistical divisions of Barwon, Central Highlands and Loddon).[23]

In the final step the average living cost figures for full-time students were applied to estimates for the number of effective full-time students (EFTSL) enrolled in higher education and VET courses at VU's Western Melbourne campuses. We do this by decomposing VU's higher education and VET EFTSL numbers into campuses and region of home residence on the basis of total enrolments by onshore site for higher education and VET students, home region indicator, and onshore/offshore ratio for international students.[24] It is estimated that 53 per cent of EFTSLs at VU's Western Melbourne campuses are for students local to the region and a further 25 per cent are from other Melbourne regions; 6 per cent are from the Rest of Victoria; 2 per cent from the Rest of Australia; and 14 per cent from overseas.[25] It is estimated that VET students are much more likely to be Western Melbourne locals (71 per cent) than higher education students (40 per cent), while 19 per cent of higher education students have an overseas home address compared to 7 per cent of VET students.

Our estimates for aggregate living-costs expenditure in 2013 by students attending VU's Western Melbourne campuses, but who are not permanent residents of the region is shown in

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education classes (higher education, vocational education, secondary school, ELICOS, and foundation studies); and 54 expenditure categories for all students.

[22] Table 11 of Western et al. (2005) shows average weekly figures, calculated on the number of weeks spent in Australia. We assume an international full-time student spends 40 weeks each year in the region in which they are enrolled, and exclude all out-of-region expenditure.

[23] It is estimated that Rest of Victoria students comprise around 5 per cent of VU students at Western Melbourne campuses.

[24] Data used here is from the 2013 VU Annual Report, which provides annual enrolment data for the number of VU higher education and VET students enrolled at each VU site (each onshore campus, industry/internet and offshore), and the home residence of VU students by region (Western Melbourne, overseas and other regions).

[25] Only one-third of VU's total enrolment of international students were at Western Melbourne campuses in 2013.

Table 3.1. Note that the table excludes all travel costs except for local transport, and that 20 per cent of all expenditure in Australia is assumed to be spent in regions outside Western Melbourne.[26]

Table 3.1: Student living-costs expenditure in Western Melbourne in 2013 ($m)

	Overseas		Interstate		Intrastate		Intra-Melbourne		
	H.Ed.	VET	H.Ed.	VET	H.Ed.	VET	H.Ed.	VET	Total
Manufacturng	16.8	4.0	1.2	0.6	2.4	0.6	1.4	0.5	27.6
Electricity, gas, water	0.6	0.1	0.0	0.0	0.1	0.0	-	-	0.9
Accommodation & food services	18.2	4.8	1.2	0.8	5.2	1.9	2.7	1.0	35.7
Transport, postal & storage	6.0	1.8	0.4	0.3	2.1	1.0	0.3	0.1	12.1
Information Media & telecomm.	5.9	1.6	0.4	0.3	1.2	0.5	-	-	9.8
Rental, hiring & real estate	1.6	0.4	0.1	0.1	0.3	0.1	-	-	2.6
Dwellings	7.9	2.1	0.5	0.3	1.7	0.6	-	-	13.1
Health care & social assistance	5.5	1.5	0.4	0.2	0.8	0.3	0.3	0.1	9.0
Arts & recreation services	5.6	1.7	0.4	0.3	1.2	0.5	-	-	9.6
Other services	11.7	2.7	0.8	0.4	1.7	0.5	0.8	0.3	18.9
	79.7	20.6	5.5	3.3	16.7	6.0	5.5	1.9	139.3

The above estimates should be considered as conservative. In applying estimates for the living costs of full-time students, there is an implied assumption that living costs for students studying less than a full-time load are a fraction of those full-time students (with the fraction being equal to the student's fraction of a full-time load). While this may be considered as the living costs associated with their study, it might also be argued that all local expenditure by an out-of-region student should be considered extra expenditure in the region, because if it were not for their part-time studies they would not be in the region. For international students, the implied average annual living costs for an international student (whether full-time or part-time) in Australia is $20,666 (= 25,832 x 0.8, where 0.8 is the estimated EFTSL/headcount ratio for international higher education students at VU). This compares with an average for all international students of $22,900 implied by survey estimates provided by Bexley et al. (2014) for annual expenditure (general and study-related) by international students by level of higher education (undergraduate, postgraduate coursework, postgraduate research).

3.1.2.2 *Associated activities*

Giesecke and Madden (2005) and Madden (2014) undertook detailed estimates of expenditure for two additional sorts of demand associated with university operations in the states of Tasmania and Queensland respectively.

The first related to university-organised conferences. One of the functions of university academics is to contribute to the activities of professional societies, which includes participating on local organising committees of conferences held in their universities regions. These conferences generally attract out of-region delegates who – particularly in the case of overseas and interstate delegates – add to the level of tourism/travel expenditure in the region.

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[26] Also note that we estimate a portion of the expenditure by students from outside Melbourne is spent in other Melbourne regions. For instance, it is assumed that only a third of Arts and recreation expenditure is spent in Western Melbourne. The average spent in Western Melbourne is 80 per cent.

The second relates to trips by friends and relatives of students whose permanent residence is outside the region.

Giesecke and Madden (2005) and Madden (2014) undertook detailed estimates of the expenditure involved in these activities for the states of Tasmania and Queensland respectively. Their results, however, indicated that these expenditures were considerably smaller than those associated with university operations and student living expenses.[27] Their studies involved regions which were states. In this study, the region of focus is only part of an urban area and there is insufficient available data to support an allocation of conference and tourism activity between the Western Melbourne region and other parts of Melbourne.[28]

Given these considerations, we did not include these associated activities in this study.

3.2 Supply-side effects

3.2.1 Increased labour productivity

There is an extensive literature recognizing that tertiary education leads to an increase in human capital, which in turn improves labour productivity. In this section we seek to obtain estimates of the impact on Western Melbourne's labour productivity in 2013 of graduates from 1992 until 2012 having obtained their qualifications from campuses within their region.[29]

There are two major components to estimating this labour productivity effect:

a. Estimation of the extent to which VU's Western Melbourne campuses have increased the stock of graduates in Western Melbourne; and

b. Estimation of the extent to which higher education and VET qualifications from VU raise a graduate's labour productivity.

We deal with these in turn in the next two sub-sections.

3.2.1.1 Estimating the number of Western Melbourne employees holding VU qualifications from a Western Melbourne campus

The first task is to obtain a time series of successful higher education and VET completions (i.e. receipt of qualification) from VU's Western Melbourne campuses for the period 1992 to 2012. DoE provides this data for all VU higher education students (including offshore campuses) for all years from 1995 onwards.[30] The 1992 and 1993 VUT Annual Reports provide data of all awards conferred in those two years, while the missing 1994 data was interpolated.

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[27] These associated activities represented around 1 per cent of the value of the two main types of expenditure.

[28] Even without the difficulty posed by allocating conference and visitor expenditure within an urban area, there is only limited data on which to estimate such expenditure at a wider regional level (i.e. metropolitan wide, state-wide or nationwide).

[29] 1992 is the year VU, then called the Victoria University of Technology (VUT), commenced operations as a university.

[30] See DoE Selected Higher Education Statistics, Table 4 of the 2004 and 2013 files for Award Course Completions. The 2013 file provides data by higher education provider for 1999 to 2013. The 2004 file extends the series back to 1995.

Completion data for VET students is less readily available. We therefore estimated a time series for VU VET completions based on data in VU/VUT annual reports for the period from 1992 to 2013.[31] The first step in this estimation procedure was to compile a time series of VU's VET student load (EFTSL). VU annual reports provide this data for the years 2006 to 2013. For most years prior to this the EFTSL number was estimated on the basis of VET student numbers reported by full-time/part-time status. Completion numbers were then estimated on the basis of national information on completion rates by level of course and VU weights for course levels.[32]

The next tasks were to remove from the two series completions from offshore campuses, and for the remaining onshore completions to extract the number of VU awards by students from Western Melbourne campuses. The completions data required to perform these tasks was not available and therefore had to be estimated from student data. It will be recalled that estimates of student numbers by overseas and domestic students for the year 2013 were made in estimating student living costs in Section 3.1.2.1, using data from the Victoria University (2013). Here we require similar data for the entire 1992 to 2013 period. VU/VUT Annual Reports from 1992 to 2013 provide annual enrolment data for both higher education and VET students by each VU site (including overseas). With regard to home residence, enrolments are decomposed by Western Melbourne, other Australian regions, and overseas for 2005 on; prior to that enrolments were categorized by Victoria, interstate and overseas.[33] Separate home residence numbers are provided for higher education and VET, except for 1992 and 2011 to 2013. These numbers cover both onshore and offshore campuses. Because the VU data for enrolments by site and by residence were not defined on the same basis, international onshore students could not be exactly computed from this data. However, from 2004 on, we were able to verify our calculation of the number of onshore overseas students, both for higher education and VET, directly from VU Annual Report data on international student enrolments by onshore and offshore VU sites.

For each year for each tertiary education category (higher education and VET), total completions was multiplied by the ratio of offshore to total students to form initial estimates of offshore completions for each category. For higher education for the period 2008 to 2013, a further estimate was made by using commencing students offshore ratios with a four-year lag. [34] For both commencing and total international students, the offshore/onshore ratio

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[31] VU annual reports for 2012 to 2014 are available online at: http://www.vu.edu.au/about-us/facts-figures/annual-reports. Annual reports from 1992 to 2011 were viewed at the VU Records and Archives Services.

[32] National completion data was provided by NCVER (2014) for the years 2009 to 2013. Actual completion data was available from VU annual reports for 1992 and 1993. NCVER data indicated a rising trend in completion rates and this was consistent with the implied completion rates for 1992 and 1993. Completion rates for the years 1994 to 2006 were interpolated assuming a constant rate of increase in completion rates for each type of attendance (full-time/part-time) with the rate of increase set at one which reproduced the previously estimated completion rate for 2009.

[33] For 2005 and 2006 there are also separate figures for the rest of Victoria and interstate.

[34] For commencing (and all) international students separate data for onshore and offshore international enrolments for each higher education provider is available for the years 2004 to 2013 from the Overseas students files of DoE (2013) and the corresponding files for 2004 to 2013 on DoE's higher education statistics site.

fluctuated markedly between years. This restricted us to making adjustments for only those years for which lagged completions data were available.

In the next step, the number of completions from Western Melbourne campuses for each tertiary category for year was estimated by applying to onshore completions the all-students enrolment ratio of Western Melbourne campuses to all Australian campuses.

Both the higher education and VET completion numbers for Western Melbourne campuses were then split between domestic and international students. This was necessary since international students were much more likely to depart for overseas (generally to their country of permanent residence) than domestic students. An initial decomposition was undertaken using domestic/overseas student ratios employing the overseas onshore student numbers estimated in a previous step. For the years 2004 to 2013, we modified these estimates by using DoE data for VU students by citizenship and residence data.

The next task was to estimate the number of higher education and VET award holders from VU Western Melbourne campuses who remained residents of the region in 2012. We do so by creating for each completions cohort a time-path for the number of award holders still remaining in Western Melbourne in each year from completion to 2013. For each cohort there are two main stages: (i) estimation of locational choice in the immediate period after graduation; (ii) estimation of the rate at which award holders leave Western Melbourne in subsequent years.

We first determined the post-graduation destination for those award holders who were overseas residents. While a substantial number of overseas students with an Australian qualification gain permanent residency in Australia under selected skilled categories (Birrell, et al., 2006, and Guo, 2010), the majority are estimated to return to their home country. On the basis of information in Sin (2006) and Guo (2010), we assumed that two thirds return to their home country, while the rest remained in Australia in their post-completion year.[35] We also assumed that a further 4 per cent departed Australia permanently in subsequent years.

In the case of domestic students, we assumed on the basis of information in Hugo et al. (2003) that only a small proportion (under half a per cent) of Australian award holders depart for overseas permanently. As around 95 per cent of domestic students are Australian citizens - the remainder mainly being New Zealand citizens or permanent residents – we assumed that for completions prior to 2009, 99.5 per cent of domestic students were resident in Australia in

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Cohort analysis of Department of Education (2015) shows that almost a third of Bachelor's Pass students are still enrolled 4 years after commencement; for honours students this figure has been under 10 per cent until recently. There were no available data nor was there any need to carry out a similar exercise for VET completions since NCVER (2014) showed the bulk of VET students completed within a calendar year.

[35] GCA (2014b) survey data on overseas graduates from Australian universities availability for full-time work in Australia or overseas (Table 9a) and their availability overseas suggests that our estimates of the number of overseas graduates remaining in Australia is conservative. For the six home-residence countries with the largest numbers surveyed, only just over 50 per cent of overseas students were available for full-time work in only overseas countries.

2013. For post-2008 completions, we assumed that 5 per cent of domestic award holders were overseas in 2013.[36]

The next task was to determine what proportion of those VU award holders who remained in Australia, also remained as residents of Western Melbourne,

For each year after graduation we assumed a certain portion of VU award holders moved out of Western Melbourne to other Australian regions. We were guided by the following sources of information: the Graduate Career Australia (GCA) annual publications *Graduate Destinations* and *Beyond Graduation* which showed the interstate mobility of higher education graduates (the former over a 3-year period);[37] and ABS population census data for LGA's which revealed the rate of emigration of Western Melbourne's residents.

We estimate that 8 per cent of Western Melbourne award holders leave the region in the year following graduation, and that the rate of departure then slows to 5 per cent a year.[38] We base the latter figure for the emigration rate on mobility figures imputed from the ABS 2006 and 2011 Censuses of Population and Housing. We do this from first computing the number of persons who were in a Western Melbourne LGA in 2006 and were still in an LGA within the region in 2011. This is then compared to the aggregate population of the Western Melbourne LGAs in 2006. This yielded an average emigration rate from Western Melbourne of 4 per cent per annum. We assume a slightly higher rate for higher education and VET award holders as they are likely to be more mobile than the population in general.

For each graduation cohort a time-path of award holders remaining in Western Melbourne in each year is then computed. The next step is to estimate how many of the award holders remaining in Western Melbourne at the beginning of 2013 are in employment in Western Melbourne. We first estimate an employment ratio for each cohort. In the next sub-section we consider the effects of tertiary qualifications on wage rates. The two papers we use there, Leigh (2007) and Wilkins (2015), also find that tertiary qualifications increase the probability of the award holder being in employment. Leigh (2007) finds a that a Bachelor's degree increases the probability of employment by 10 per cent, and a VET qualification increases the probability of employment by between 3 per cent (for a Diploma and 12 years of schooling) and 16 per cent (for a Certificate I/II and 11 years of schooling).[39]

We estimate an employment rate of 82 per cent for VU higher education graduates for each graduation cohort up to 2008. For subsequent cohorts, we assume a lower employment rate as

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[36] This estimate is based on GCA (2010) which found that 6.8 per cent of Australian citizens who graduated from an Australian higher education institution in 2006 were working overseas in 2009. GCA (2010) was the inaugural *Beyond Graduation* report published by Graduates Careers Australia, and was the only one in the 2009 to 2013 series to report the proportion of Australian graduates working overseas.

[37] See for instance, Table 8 of GCA (2014a) and GCA (2014b).

[38] The 2010 to 2013 *Beyond Graduation* reports indicate that Victorian graduates are much more likely to stay within the state in which they commence employment than is the case for other states and territories. Interstate mobility is 7.5 per cent over 3 years for graduates working in Victoria, while the average figure for the other states and territories is 12.4 per cent.

[39] The result for Certificate III/IV award holders with 12 years of schooling was not significant, and we assume that the qualification has no effect on employment.

up to 19 per cent of graduates proceed to further full-time study (see Figure 3, GCA, 2014a). We further assume that only 52 per cent of Western Melbourne work in their region of residence, this being the proportion of all Western Melbourne employed residents who work within their home region. This yields an estimate of 11.6 thousand graduates who obtained their degrees from VU's Western Melbourne campuses who in 2013 were Western Melbourne residents and working in the region.[40] We undertake a similar exercise for VU VET award holders, and estimate that 14.9 thousand VET award holders were living and employed in Western Melbourne.

It could well be that under the counterfactual of VU not having campuses in Western Melbourne, a substantial proportion of the 26.5 thousand award holders would have instead obtained their degrees from other higher education institutions in other Melbourne regions and in 2013 would still have been working in Western Melbourne. It will be recalled, that under our basic scenario, it is assumed that there would not be any change in tertiary education attendance under the counterfactual. However, it is possible that attendance by Western Melbourne residents at tertiary education institutions in other Melbourne regions rather than in their home region may weaken award holders attachment to Western Melbourne and lead to a faster rate of (gross) emigration from the region. Bound et al. (2004) and Groen (2004) look at the effect on migration of college location, but their estimations are at the state level and for the United States where the culture of moving interstate to attend a university differs markedly from Australia. Those papers find a much higher rate of graduate emigration than we assume for Western Melbourne. For instance Groen (2004) finds that only 10 per cent of those who graduated from a university in a particular state are still living within that state after 10 years. Let us assume that this would have been the rate that Western Melbourne residents with VU award would have left the region under the counterfactual situation. This would have reduced the number of VU Western Melbourne award holders working in the region to 17 thousand (6.9 thousand higher degrees plus 10.1 thousand with VET qualifications). Thus the existence, of VU's Western Melbourne campuses over the 1992 to 2012 could be seen as increasing the number of VU award holders working in Western Melbourne by 9.5 thousand (4.7 thousand higher education and 4.8 thousand VET).[41]

3.2.1.2 *Estimating the labour productivity effects of VU qualifications*

The next task is to estimate how much a VU qualification adds to Western Melbourne's labour productivity. There is a long international literature on the private and social returns to higher education. In the case of Australia, estimates over the past three decades show private rates of returns to a university degree of the order of 15 per cent (Borland et al., 2000). This amounts to a typical wage premium of around 30 per cent over a post-degree working life of around 35 years.

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[40] Thus, around 36 per cent of all VU Western Melbourne completions are estimated to be employed persons living in Western Melbourne, of which just over half (18 percentage points) are estimated to be working in Western Melbourne.

[41] It is also a possibility that the number of VU Western Melbourne award holders who emigrated from the region, work in Western Melbourne. The number doing so might be lower under the counterfactual; again because of a lower attachment to the region.

More recent research by Leigh (2007) and Wilkins (2015) provide econometric estimates for returns to both higher education and VET qualifications based on data from the HILDA Survey.[42] Leigh estimates the percentage effects on hourly wages and annual earnings of 6 levels of awards - 3 for higher education and 3 for VET. In the case of the VET qualifications, Leigh also shows separate estimates for wages and earnings depending on the number of years of schooling (12 years or up to 11 years).[43] Wilkins presents a similar array of estimates, but not for VET Certificates I/II, and only relative to Year 11 and below, returns to Year 12 education being shown separately.[44] Both authors show two sets of estimates, one assuming no ability/cognitive bias and the other correcting for this type of bias.[45]

In order to translate these findings into a per VU award impact on labour productivity for both higher education and VET award holders in Western Melbourne in 2013, we needed to apply VU weightings to the wage premium estimates. We started with Leigh's estimates, which allowed for 10 per cent ability bias, by award type and years of schooling. For higher education, Leigh assumes all students had completed year 12. In order to obtain an average wage premium due to a higher education award, Leigh's estimates for three classes of university awards (Bachelor degree, Graduate diploma/certificate, Masters or Doctorate) were weighted by VU higher education completions by award level.[46] This yielded an average wage premium for each VU higher education completion of 27 per cent. For VET awards an extra step was required, to account for Leigh's separate estimates for students who had completed Year 12 and those who had not. We weighted these estimates on the basis of educational attainment data for 2007 to 2011 for Australian VET students in Table B.1 of DIICSRTE (2012). Then, as with higher education, we weighted the estimates for three classes of (Certificate I/II, Certificate III/IV and Diploma/Advanced Diploma) by estimates for VU award completions by these levels. This yielded an average wage premium for VU VET awards of 4 per cent.[47]

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[42] The HILDA (Household, Income and Labour Dynamics in Australia) Survey is a longitudinal survey conducted annually since 2001.

[43] Certificate I and II are shown only for 11 years of schooling or fewer, as these certificates are considered a lower level of attainment than Grade 12 (Leigh, 2007, p. xiii.).

[44] Wilkins (2015) also presents separate estimates for male and female employees, but not for total employees, and weekly earnings estimates are for full-time employees only.

[45] There is a substantial literature on the "signalling" aspect of educational qualifications, which recognizes that only part of the wage premium represents a return to knowledge obtained from undertaking the course, with the remaining component of the wage premium being due to the qualification signalling the holder's innate ability (Spence, 1973). Borland et al. (2000) note a standard assumption is that 20 per cent of the wage premium is due to signalling. Leigh (2007) takes innate ability into account by assuming it to be 10 per cent. This would seem a reasonable assumption, given Lange and Topel (2006) – not cited by Leigh - find a 10 per cent upper limit on the signalling component. Wilkins (2015) corrects for the ability effect through 3 cognitive ability tasks included in the interview section of Wave 12 of the HILDA Survey (Wilkins, 2015, pp. 61 and 70). It might also be noted that we do not take any account of graduates possibly having positive labour market externalities on other workers.

[46] Note that Leigh shows estimates relative to no post-school qualifications. As we apply these premiums to completions for individual degrees it was therefore necessary to subtract from post-graduate awards the premium from a Bachelor's degree.

[47] The lower wage premia from VET awards is consistent with the typically much shorter length of time required to obtain them compared to higher education awards.

We then carried out a similar exercise for Wilkins' (2015) estimates for the full-time weekly earnings premia of full-time employees holding higher education and VET awards. Estimates by gender were averaged for each of the award categories using weights formed on the basis of national figures for educational qualifications by gender in ABS (2013a). This yielded estimates for earnings premium of 17 per cent for each higher education completion and 9 per cent for each VET completion.

In estimating the average wage/earnings premiums for higher education and VET awards, we accounted for the qualifications which would normally be required to undertake study for that level of qualification.[48] However, the premium estimates were made on the basis of the highest level of educational attainment, and as Leigh (2007) notes Wilkins do not allow for the possibility that students obtain more than one qualification at the same level of educational attainment.[49] There is no readily available information on the number of such multiple qualifications or their likely effects on wage rates.

For the purpose of this study, we assumed an average wage premium of 20 per cent for higher education awards and 5 per cent for VET awards respectively. These numbers are conservative, with the assumed higher education premium being lower than those assumed in most recent studies, but are consistent with the above discussion of the findings by Leigh (2007) and Wilkins (2015) and make allowance for the possibility that double degrees may lower the wage premia of individual awards (although not necessarily their rate of return).

Applying these wage premia to the number of additional Western Melbourne award holders' wages implies a $62.4 million (or 0.33 per cent) increase in average Western Melbourne labour productivity and a 0.048 per cent reduction in labour productivity in other Melbourne regions.

3.2.2   Impacts of VU research in Western Melbourne campuses on VU productivity

As well as adding to economic productivity by increasing human capital through their teaching activities, the other main way that universities increase productivity is through their research activity. In this section we estimate the extent to which VU research activity at its Western Melbourne campuses has added over the years to the stock of knowledge, and the degree to which it has increased productivity both in Western Melbourne and in other Australian regions.

We start by estimating the value of VU research at its Western Melbourne campuses for each year over a period of 21 years from the beginning of 1992 to the end of 2012. Each year's research adds to the stock of knowledge, which we measure in terms of the dollar value of accumulated research spending. We then assume a rate of return to university research and apply this to the accumulated stock of knowledge (after allowing for a gradual decay in its value) at the commencement of 2013.

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[48] For example if a Masters/PhD degree was estimated to yield a wage premium of 41 per cent relative to Year 12 qualifications and for a Bachelor's degree the corresponding premium was 32 per cent, then it was assumed that the return from a Masters/PhD relative to a Bachelor's degree was 9 per cent.

[49] For a hierarchy of levels of educational attainment, see ABS (2014a).

The first task is to estimate VU's annual expenditure on research over the period. This expenditure is assumed to consist of grants and other income provided to VU so as to undertake research, plus the value for academics' time in undertaking their normal research activity. There is data on the first of these items, but the latter value must be imputed. Figures were obtained from VU's research office for the value of research income, as submitted to the Department of Education for the Higher Education Research Data Collection (HERDC), for each year from 1992.[50]

The next task is to estimate an imputed value for academics' time (and other research emanating out of general university funds). ABS (2014b) provides biennial data for research income by source from 1994. This data contains a category, General university funds, which is an estimate of the value of academics research time (plus administrative research support) not covered by external research funding. General university funds make up 57 per cent of the ABS' estimate for the funding of research and experimental development by Australia's higher education organisations in a typical year since 1994. For each year, the ratio of total research funding to external research funding was applied to the value of VU's HERDC reported research funding to obtain a time series of estimates for VU's total research expenditure.[51] The proportion of VU research expenditure that could be attributed to the University's Western Melbourne campuses was then estimated on the basis of the regional distribution of VU academics (which in turn is assumed to follow the regional distribution of the University's higher education students).

We assume the value of the stock of research knowledge generated by VU's Western Melbourne campuses is measured as the accumulated value of VU's research (and experimental development) expenditure at these campuses. It is assumed that the stock of knowledge decays at the rate of 10 per cent per annum. By 2013, the accumulated stock of knowledge was computed as $167.4 million.

The next step is to assume a rate of return on this stock of knowledge. There is a considerable literature on the returns to research. Much of this literature is for private research and relates to other countries (e.g. Griliches, 1992, and Hall, et al., 2010). Industry Commission (1995) contains a comprehensive examination of the issues relating to the returns to university research in Australia. They also undertake some of their econometric estimations, attempting to control for some sources of bias found in international studies. The IC found that overall Australian research and development yielded a total rate of return to the economy of between 50 and 60 per cent. This estimate was made assuming that R&D did not affect non-market sector productivity. Re-estimation by the IC under the assumption that non-market sector productivity kept pace with market sector productivity, yielded a rate of return of 90 per cent. The IC noted some possible limitations with these estimates, and that under some assumptions the rate of return could be as low as 25 per cent.

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[50] The time series of VU research expenditures were provided in current prices, and were subsequently converted to 2013 prices.

[51] Thus account was taken of the increase (as revealed by the ABS data) in universities use of external funding to support their research and experimental development.

Overseas evidence suggests that publicly-funded R&D yields a lower rate of return than privately-funded R&D (Lichtenberg, 1992, and Salter and Martin, 2001). Dixon and Madden (2003, page 2), in their study of the impact of ARC research, considered it "likely that the competitive process that is at the core of ARC funding generates a higher return than total publicly-funded research". Leyden and Link (2014) present a similar argument in contending that university research may be more efficient than public research generally. Category 1 funded research (which comprises ARC and other Australian competitive grants), however, comprised only around 12 per cent of total Victoria University research funds in an average year since 1992. A substantial proportion of university research funding is not so clearly competitive. This includes the proportion of academics' time considered to be devoted to research, estimated in a previous step.[52] In light of this, we assume a rate of return to research of 30 per cent (ignoring any spillovers to other countries).

There is good reason for taking a conservative approach to the rate of return on university research. In our modelling we express the returns to research as an improvement in primary factor productivity. It is assumed that there are no lags between the increase in the stock of knowledge (in the subsequent year to the research spending) and the earning of the returns. It is unlikely that there is such an absence of lags in actuality. Pure basic research comprised just under 30 per cent of Australian research expenditure since 1994 and a further 22 per cent consisted of strategic basic research.[53] It could be expected that the findings from these two types of research, particularly the former, would not have a significant impact on productivity for some years.

In modelling the regional impact of VU's research at Western Melbourne campuses, assumptions must be made about the geographic boundaries within which the returns from VU' research activities accrue. We assume, in line with standard R&D returns estimation practices, that the nation as a whole earns the rate of return of 30 per cent from the University's research activity at Western Melbourne campuses. However we assume that only 20 per cent of these benefits are enjoyed exclusively by Western Melbourne (reflecting a propensity for VU researchers in Western Melbourne to investigate local issues) and that 80 per cent of these benefits are enjoyed more widely (i.e. in Western Melbourne and other regions).[54]

In our simulations of the research component of VU's impact on the Western Melbourne economy, we model just the net effect of the localized research productivity benefits occurring in Western Melbourne rather than in the other Melbourne regions. The 2013 returns

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[52] Ultimately of course academics must publish quality research as part of their performance indicators. However, there are no requirements that ensure academics' research time is devoted to research with a high social rate of return.

[53] There is considerable variation across states, and presumably even more so across universities. It may well be that VU has had a greater percentage of research expenditure in applied research and experimental development than the national average, but it is still likely that the University undertakes a substantial proportion of basic and strategic research.

[54] There is an extensive literature on the benefits of universities to their local economies (see, for instance, Florax, 1992, Feldman and Desrochers, 2003, Drucker and Goldstein, 2007, Fritsch, M. and Slavtchev, 2007, Dalziel et al., 2009, and Harris et al., 2011).

from the VU Western Melbourne campuses at a 30 per cent rate of return were $50.2 million. Thus, we model the effect of none of the VU research-generated local productivity effects occurring in Western Melbourne, but rather occurring in other Melbourne regions, as a $10 million (0.03 per cent) deterioration in Western Melbourne primary-factor productivity and a $10 million (0.004 per cent) improvement in primary-factor productivity in the three other Melbourne regions.

3.3 Tertiary participation effects

It is assumed in the estimations of the direct impacts of VU having campuses in Western Melbourne that if the region's residents had not had VU's Western Melbourne campuses to attend, that they would have undertaken their studies at tertiary institutions in other Melbourne regions. We now consider the possible effects having local university campuses might have on participation.

Parker et al. (2015) found that distance to a university campus did increase the probability of university attendance particularly for students of lower socioeconomic status (SES). The study by Parker et al., however, defined a university being in proximity if it were within a commuting distance of 20 km.[55] While a substantial part of Western Melbourne is more than 20 km from university campuses in other parts of Melbourne, a large proportion of Western Melbourne's residents live within 20 kms of the city. However, the number of universities in proximity to Western Melbourne is relatively small, with a number of universities in Greater Melbourne being more than 20 kms from most of Western Melbourne's population. This restricts Western Melbourne's residents' access to universities with the profile that VU currently offers to students from the region. Parker et al. (2015) found that proximity to a university increased the probability of lower SES students attending university by 14 percentage points. Here, for our alternative contribution scenario, we assume that VU's presence in Western Melbourne increases the probability of university attendance by the region's residents by 5 percentage points (i.e. from 50 per cent to 55 per cent).[56]

4   Simulation Assumptions

4.1 Economic contribution

In order to assess the contribution of VU's Western Melbourne campuses, we need to devise a simulation that projects what the economies of Western Melbourne and of the other Australian regions would look like if those campuses had not been located in Western Melbourne (i.e. the hypothetical or counterfactual scenario), but rather elsewhere in other

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[55] Much of Parker et al.'s study is concerned with attendance at G08/elite universities.

[56] Western Melbourne has higher tertiary education participation than might be expected on the basis of its socioeconomic profile. Participation, however, is lower than for some other parts of Melbourne. In the next phase of our research modelling of Western Melbourne tertiary education, it is intended to examine the economic effects of VU adopting strategies which further raises university participation in the region – to a level where ultimately the tertiary education qualifications profile of Western Melbourne residents is the same as for the average for the whole of Melbourne.

Melbourne regions. The simulation conducted is one which provides the long-run effects of such a hypothetical relocation.

The implied assumption underlying this simulation is that it incorporates full adjustment to this hypothetical relocation, thus mimicking the counterfactual of VU having had no campuses in Western Melbourne for many years.[57] Hence, we assume in the simulation that the location of VU campuses in Western Melbourne has no effect on the aggregate level of Australian employment which may be seen as being dependent in the long run on demographic and industrial relations factors. At the national level the real wage adjusts to accommodate this.

However, the counterfactual is modelled as having some permanent effects on the industrial, occupational and regional pattern of employment. It is assumed that workers will choose the region in which they wish to be employed on the basis of relative regional real wage rates. Where, regions are geographically distant (e.g. Rest of Australia and Western Melbourne) this implies migration, while for proximate geographic regions it implies changes in journey to work patterns.

The rate of return on capital for each regional industry is assumed not to be affected by the location of VU campuses in the long run, rather rates of return are seen as being dependent on the world interest rate level. Investment in individual regional industries is assumed to move approximately in line with changes in their long-run capital stocks.

It is assumed that real public consumption always moves by the same percentage as real private consumption. This assumption may be considered to embody the idea that government largely directs its expenditure to where people live more than to where they work.

Madden (2014) notes that attendance at university implies that the student has less time to engage in paid employment. He took this into account in his modelling of Queensland universities by a reduction in Australia's labour supply. In our primary contribution simulation, we assume that there is no change in tertiary education participation for Greater Melbourne. For this simulation, we assume that there is no effect on labour supply. For the simulation involving an increase in tertiary participation, labour supply is modelled as decreasing slightly in the short-term as new domestic enrolments offer a smaller number of hours to the labour market, but this is offset in the longer run as award holders increase their workforce participation.[58]

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[57] Recall that our computation of the effects on the 2013 stock of research knowledge and human capital involves accumulated knowledge from 1992 onwards.

[58] The reduction in workforce participation by new domestic students is also partially offset in the short-run by overseas students who take up part-time employment.

5 Results

5.1 *Economic Contribution of VU to the Western Melbourne Economy*

5.1.1 Demand-side contribution

The contribution of 2013 expenditures arising from the location of VU campuses in Western Melbourne to the region's macroeconomic variables is shown in Table 5.1.[59] For the effects on all regions see Table B.1.1 of Appendix B.

5.1 Demand-side Contribution of VU local campuses to the Western Melbourne Economy					
	% Change	$ million		% Change	$ million
Real Private Consumption	0.72	233	Net Margins & Change in	n.a.	-21
Real Public Consumption	0.72	74	Stocks		
Real Investment	2.62	251	Labour	1.64	310
Overseas Exports	1.92	68	Capital	1.65	157
Overseas Imports	0.51	15	Indirect taxes	0.97	49
Interregional exports	0.10	12	Technical change	0.00	0
Interregional imports	0.29	87	Real GDP	1.46	515

It can be seen from the last row of the right hand columns of Table 5.1, the University's local campuses' contribution to Western Melbourne's 2013 GDP is estimated at 1.46 per cent (or around $515 million). The direct impact of VU's local operations and student living costs on the Western Melbourne economy in GDP terms is $369 million.[60] Thus the net indirect demand-side effect of VU on the region's GDP is 113 million.

The University's percentage contribution to the region's employment (1.64 per cent) is larger than it is for GDP, reflecting the Higher education industry being more labour intensive than is the case for Western Melbourne's industries on average.[61] The percentage contribution of VU to Western Melbourne's capital stock is similar to employment.[62]

Looking at the contribution to GDP from the expenditure side, it can be seen that the percentage changes in real private and public consumption are just under half of that of GDP. This reflects the presence of interregional commuting and interregional ownership of assets incorporated within the TERM-WM model; Western Melbourne residents receive only part of the increase in factor returns generated in their home region and also bear some of the reduction, relative to the counterfactual, in factor returns that occur in other Melbourne

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[59] Recall that we show contribution results as being the same magnitude, but of opposite sign, to the long-run results of the simulation which hypothetically closed down VU's Western Melbourne campuses.

[60] The estimated direct output impacts are $377 million from VU Western Melbourne operations and $139 million from student living costs. The direct GDP components (value added plus indirect taxes) of these are $299 million for VU operations and $70 million for student living costs.

[61] For Higher Education, the ratio of labour to all primary factor inputs is 0.91, compared to 0.63 for the Western Melbourne all industries average.

[62] The higher percentage contribution for employment and capital stock compared to GDP results from their being no change in the region's supply of land (mainly residential land) which accounts for 5 per cent of the region's GDP and a comparatively small impact on indirect taxes which comprise 14 per cent of Western Melbourne's GDP, but make up little of tertiary education inputs.

regions (columns 2 to 4 of Table B.2.1 of the Appendix). On the other hand, the demand-side impact of VU's local campuses of 2.62 per cent on Western Melbourne's real investment is considerably greater than the GDP impact, which is the consequence of a very high investment to capital ratio for the tertiary education industries in the TERM-WM data base. The percentage contribution to overseas exports is also more than it is for GDP, reflecting the fact that estimated overseas students contributed almost three quarters of estimated out-of-region living costs.

The VU demand-side effects on regional industries' output and employment are shown in Table 5.2.

5.2 Demand-side Contribution of VU local campuses to Western Melbourne Industries
(percentage change relative to counterfactual)

	Output	Employment		Output	Employment
1 Agriculture, forestry & fishing	-0.66	-1.04	12 Rental, hiring & real estate services	0.71	0.59
2 Mining	-0.31	-0.72	13 Dwellings	2.72	4.19
3 Manufacturng	-0.53	-0.66	14 Professional, scientific & tech. services	-0.12	-0.18
4 Electricity, gas, water & waste services	0.12	-0.05	15 Administrative & support services	-0.32	-0.33
5 Construction	1.95	1.89	16 Public administration & safety	0.00	-0.05
6 Wholesale trade	-0.02	-0.13	17 School & other non-tertiary education	0.20	0.18
7 Retail trade	0.22	0.13	18 Technical and vocational education	-0.51	-0.35
8 Accommodation & food services	2.37	2.34	19 Higher education	100.00	100.00
9 Transport, postal and warehousing	-0.26	-0.39	20 Health care & social assistance	0.35	0.32
10 Information Media & telecommunications	0.16	0.00	21 Arts & recreation services	0.28	0.20
11 Financial & insurance services	-0.26	-0.43	22 Othe services	1.17	1.14

It will be recalled that, because VU is a dual-sector university, both the higher education and VET components of VU are assigned to the Higher education industry in the ABS input-output industry (and thus TERM-WM's) industry classification scheme. Since VU is the only higher education institution within Western Melbourne, the University is responsible for all Higher education activity in Western Melbourne. For the other Melbourne regions, Higher education output is reduced relative to what it would have been under the counterfactual. Similarly, Technical and vocational education output in the other Melbourne regions is lower than it would have been under the counterfactual. It can be seen that Technical and vocational education output is also almost 1 per cent lower than under the counterfactual, since VET students attending VU's Western Melbourne campuses diverts enrolments from other Technical and vocational education institutions in Western Melbourne, as well as away from dual-sector institutions, TAFEs and other VET institutions in the other Melbourne regions.

The main non-education Western Melbourne industries to benefit from VU's presence in the region are Accommodation & food services, as a result of out-of-region students' living costs, Dwellings and Other services, both from living costs and the general expansion in the region's economy, and Construction as a result of VU's stimulus to investment in the region. Western Melbourne's Agriculture, forestry & fishing, Mining, and Manufacturing industries experience a negative effect on output and employment due to a degree of local crowding-out as resources are pulled into the positively-affected Western Melbourne industries, particularly the Higher education industry. Technical

5.1.2   Supply-side contribution

VU's supply-side contribution Western Melbourne's economic aggregates in 2013 are shown in Table 5.3. For the impacts on each regional economy of these shocks, see Table B.2.1 of Appendix B.

Table 5.3 Supply-side Contribution to Western Melbourne Economy					
	% Change	$ million		% Change	$ million
Real Private Consumption	0.06	20	Net Margins & Change in	n.a.	2
Real Public Consumption	0.06	6	Stocks		
Real Investment	0.25	24	Labour	0.00	0
Overseas Exports	0.39	14	Capital	0.25	24
Overseas Imports	0.16	5	Indirect taxes	0.15	7
Interregional exports	0.43	54	Technical change	0.20	72
Interregional imports	0.04	13	Real GDP	0.29	103

The supply-side contribution of VU locating campuses in Western Melbourne arise from the 2013 labour productivity and all-factor productivity improvements which in turn flow from the region's workforce extra human capital and its industries' improved knowledge base - both accumulated over the years from 1992.

It can be seen that the VU generated productivity improvements in Western Melbourne increase the region's GDP in 2013 by 0.29 per cent ($ 103 million). Again, the effects on real private and public consumption are muted.

There is a negligible contribution to employment (0.003 per cent or 7 jobs), since the lower labour requirement per unit of output offsets the incentive that a fall in real unit labour costs (of 0.12 per cent) gives to producers to increase their labour usage.[63]

The capital stock moves by a similar percentage to GDP, since in the long run effective capital to effective labour ratios move back towards their pre-shock levels.[64] It will also be noted from Table 5.3 that, for the supply-side contribution simulation, the percentage effects for the capital stock and real investment are similar since the productivity effects fall across all industries.

Since, our primary scenario involves a locational shift in tertiary studies and research from other institutions in the other Melbourne regions, these regions are consequently negatively affected (columns 2 to 4 of Table B.2.1) by the supply-side impacts of VU's location in Western Melbourne, as they are by the demand-side impacts.

The supply-side effects on Western Melbourne industries are shown in Table 5.4. It can be seen that all industries in the region benefit from the productivity effects (except for Higher

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[63] See Giesecke and Madden (2013, p. 450) for an explanation of this mechanism.
[64] The percentage change in effective units of a primary factor is equal to the combination of the percentage change in the number of physical units of the factor and the percentage change in the technical efficiency of the factor.

education for which we have imposed a zero change in output to prevent double counting). Industries to expand most are characterised by elastic demand curves (more highly traded goods) and/or labour intensity (thus benefitting from the labour-saving productivity improvements).

Table 5.4: Supply-side Contributions to Western Melbourne Industry Output and Employment
(percentage change relative to counterfactual)

	Output	Employment		Output	Employment
1 Agriculture, forestry & fishing	0.38	0.19	12 Rental, hiring & real estate services	0.40	0.11
2 Mining	0.18	0.00	13 Dwellings	0.22	0.08
3 Manufacturng	0.47	0.16	14 Professional, scientific & tech. services	0.54	0.21
4 Electricity, gas, water & waste services	0.22	-0.06	15 Administrative & support services	0.56	0.21
5 Construction	0.36	0.04	16 Public administration & safety	0.33	0.00
6 Wholesale trade	0.23	-0.09	17 School & other non-tertiary education	0.18	-0.17
7 Retail trade	0.26	-0.07	18 Technical and vocational education	0.57	0.22
8 Accommodation & food services	0.26	-0.07	19 Higher education	0.00	0.00
9 Transport, postal and warehousing	0.33	0.03	20 Health care & social assistance	0.19	-0.16
10 Information Media & telecommunications	0.34	0.06	21 Arts & recreation services	0.32	0.00
11 Financial & insurance services	0.35	0.08	22 Othe services	0.27	-0.07

5.1.3   Total Contribution

The total (demand-side and supply-side) contribution of VU's campuses in Western Melbourne to the region's macroeconomic variables in 2013 is shown in Table 5.5.

The contribution effect of VU locating up to 85 per cent of its activities in Western Melbourne is estimated to increase the region's real GDP by 1.75 per cent ($617 million) in 2013. On the expenditure side, $333 million of this GDP increase is accounted for by real (private and public) consumption. The University's presence in Western Melbourne is estimated to increase the region's employment by 1.63 per cent, or around 4,350 jobs.

Table 5.5   Total Contribution of VU's Western Melbourne Campuses to the Region's Economy

	% Change	$ million		% Change	$ million
Real Private Consumption	0.78	253	Net Margins & Change in	n.a.	-19
Real Public Consumption	0.78	80	Stocks		
Real Investment	2.87	275	Labour	1.63	309
Overseas Exports	2.31	82	Capital	1.90	180
Overseas Imports	0.67	19	Indirect taxes	1.12	56
Interregional exports	0.52	66	Technical change	0.20	72
Interregional imports	0.33	100	Real GDP	1.75	617

The total effects on Western Melbourne's industries are shown in Table 5.6.

For the effects on all regions see Tables B.3.1 and B.3.2 of Appendix B.

Table 5.6: Total effects of VU's Local Campuses on Western Melbourne's Industry Output and Employment
(percentage change relative to counterfactual)

Industry	Output	Employment	Industry	Output	Employment
1 Agriculture, forestry & fishing	-0.28	-0.85	12 Rental, hiring & real estate services	1.12	0.70
2 Mining	-0.12	-0.72	13 Dwellings	2.94	4.27
3 Manufacturng	-0.06	-0.50	14 Professional, scientific & tech. services	0.42	0.03
4 Electricity, gas, water & waste services	0.35	-0.10	15 Administrative & support services	0.25	-0.12
5 Construction	2.30	1.93	16 Public administration & safety	0.33	-0.05
6 Wholesale trade	0.21	-0.22	17 School & other non-tertiary education	0.38	0.01
7 Retail trade	0.47	0.06	18 Technical and vocational education	0.06	-0.13
8 Accommodation & food services	2.64	2.28	19 Higher education	100.00	100.00
9 Transport, postal and warehousing	0.07	-0.36	20 Health care & social assistance	0.54	0.16
10 Information Media & telecommunications	0.50	0.05	21 Arts & recreation services	0.60	0.20
11 Financial & insurance services	0.10	-0.35	22 Othe services	1.44	1.07

5.2 Impact of an increase in Western Melbourne tertiary participation and retention rates

Section 5.1 presented contribution estimates under our primary scenario. It will be recalled from Section 2.3.2 that under this scenario, the contribution of VU's Western Melbourne campuses is estimated under the assumption that all of the students who were enrolled at those campuses for the years 1992 to 2013 would have under the counterfactual have studied at other campuses in other Melbourne regions. Thus, we see in Appendix B that whereas the Western Melbourne economy is larger as a result of VU locating campuses there, the reverse is the case for the three other Melbourne regions. That is, the Section 5.1 results show the effects of a spatial relocation of resource use and productivity effects.

In this section, we conduct a new set of simulations under our alternative scenario. Under this second scenario, we assume that not all students would have studied in a tertiary institution in another Melbourne region, but would instead have been in the workforce for the length of the "forgone" course. The main effects of this are that under the counterfactual there would have been less tertiary activity in other regions of Melbourne, and less productivity effects across Melbourne (due to fewer graduations and research from higher education and VET institutions in the other Melbourne regions). These factors can be expected to increase the contributions of VU locating campuses in Western Melbourne, both to the local region and to the other regions of Melbourne, and more broadly to Australia as a whole.

In our simulations, we focus on the productivity effects arising from VU's Western Melbourne focus increasing tertiary education participation.[65] As discussed in Section 3.3, we assume that 10 per cent of enrolments at VU's Western Melbourne campuses are due to increased tertiary education participation emanating from the University locating in the

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[65] The main demand-side effect of lower activities in other Melbourne regions by the two tertiary education industries can be expected to be a reallocation of resources between Australia's domestic industries, with little effect on Western Melbourne. It is assumed that under the second scenario that there are no effects on overseas onshore student enrolments in Australia.

region. In the counterfactual (of VU not locating in Western Melbourne), the lower tertiary participation further worsens labour productivity in Western Melbourne since fewer local residents have their human capital increased by studying at universities outside the region. The lower tertiary education participation also has a deteriorating effect on the human capital of other regions, including a small reduction outside Melbourne as the number of graduates who over time migrate to the Rest of Victoria and interstate is reduced in line with the reduced number of Melbourne graduates.

It is also assumed that the lower tertiary participation in the counterfactual reduces the amount of university research in Melbourne. This not only has a deleterious effect on all-factor-saving productivity in the three other Melbourne regions, but it also affects Western Melbourne and the non-Melbourne regions, as it reduces interregional knowledge spillovers.

We conduct simulations which include all of the above productivity effects as well as those demand-side and supply-side effects modelled in Section 5. The results of the simulations for Western Melbourne under this alternative scenario are shown in Table 6.1 for economic aggregates and Table 6.2 for industries.

Table 6.1 Total Contribution to Western Melbourne Economy - Alternative scenario

	% Change	$ million		% Change	$ million
Real Private Consumption	0.80	259	Net Margins & Change in	n.a.	-19
Real Public Consumption	0.80	82	Stocks		
Real Investment	2.93	281	Labour	1.63	309
Overseas Exports	2.38	84	Capital	1.95	185
Overseas Imports	0.69	20	Indirect taxes	1.15	57
Interregional exports	0.57	72	Technical change	0.23	80
Interregional imports	0.35	108	Real GDP	1.79	632

Table 6.2: Total effects on Western Melbourne industries - Alternative scenario
(percentage change relative to counterfactual)

	Output	Employment		Output	Employment
1 Agriculture, forestry & fishing	-0.24	-0.83	12 Rental, hiring & real estate services	1.17	0.72
2 Mining	-0.10	-0.72	13 Dwellings	3.01	4.34
3 Manufacturng	-0.01	-0.48	14 Professional, scientific & tech. services	0.47	0.05
4 Electricity, gas, water & waste services	0.37	-0.11	15 Administrative & support services	0.30	-0.11
5 Construction	2.37	1.97	16 Public administration & safety	0.36	-0.06
6 Wholesale trade	0.24	-0.22	17 School & other non-tertiary education	0.40	-0.01
7 Retail trade	0.50	0.06	18 Technical and vocational education	0.11	-0.12
8 Accommodation & food services	2.68	2.28	19 Higher education	100.00	100.00
9 Transport, postal and warehousing	0.11	-0.35	20 Health care & social assistance	0.56	0.15
10 Information Media & telecommunications	0.53	0.05	21 Arts & recreation services	0.62	0.19
11 Financial & insurance services	0.14	-0.34	22 Othe services	1.47	1.06

It can be seen that the contribution to Western Melbourne's 2013 GDP of VU's local presence increases by $15 million to $632 million. The contribution to Western Melbourne's real private and public consumption accounts for all of the GDP increase, which is a result of the

productivity contributions of VU's impact on tertiary participation being dispersed across all four Melbourne regions. There is no change in the contribution to employment, however, reflecting the offsetting effects on regional employment of labour productivity improvements (as discussed in Section 5.1.2.

It can be seen by comparing Table B.4.1 with Table B.3.1 (see Appendix B) that the beneficial effects on tertiary participation also have positive effects on the other regions.

6   Summary and Conclusions

This study undertakes an economic-modelling analysis of the current significance of VU to the Western Melbourne economy.

VU is the only one of Melbourne's seven universities to locate campuses in the Western Melbourne region. The study's main findings are that, compared with the situation of there being no university campuses in the region, VU's presence added $630 million to Western Melbourne's 2013 GDP and boosted the region's employment by just over 4,350 jobs in that year.

The study assesses both VU's demand-side impacts (through its own expenditure and that of the students it attracts to the region) and its supply-side impacts (or knowledge effects) on Western Melbourne. Knowledge effects examined include increased labour productivity by the Western Melbourne workforce and increased industry productivity arising from VU R&D. The counterfactual assumption is that if VU had not located in Western Melbourne that there would have been no university in the region in the 1992 to 2013 period, and that students who in actuality had studied at a VU Western Melbourne campus in that time are assumed to have either attended a university in another Melbourne region or forgone a university education.

In order to undertake the analysis a 6-region version of CoPS' multiregional economic model TERM was developed. The regions were Western Melbourne, Inner Melbourne, Outer South-East Melbourne, the Rest of Melbourne, the Rest of Victoria and the Rest of Australia. The model allowed for interregional commuting within Greater Melbourne, with households who worked in a region different from their place of residence being modelled as undertaking their household purchases at outlets located in their region of residence.

The demand-side impacts of the University's dual-sector activities (higher education and VET) are found to have increased Western Melbourne GDP by $515 million in 2013, while the supply-side effects contributed a further $118 million.[66]

These results involved a careful estimation (see Section 3.1.2) of the direct effects that the University had on local demand and on productivity. In order to assess the demand-side contribution it was necessary to: (i) decompose VU's financial accounts and student numbers between Western Melbourne campuses, other campuses in Melbourne, and other locations both onshore and offshore. Estimates of living expenditure by international, interstate and intrastate students studying at VU's Western Melbourne campuses were computed on the basis of survey results for student living-costs.

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[66] Note that individual numbers, here and throughout this report, may not exactly sum to totals due to rounding.

Spending by the University and of the students VU attracted to the West amounted to over $0.5 billion in 2013. A high proportion of VU's expenditure was on labour and capital, and this directly added $299 million to the region's value-added (i.e. GDP at factor cost). Student expenditure also directly increased value-added in the region by $70 million (i.e. the value-added component of local-produced goods and services purchased by students). Multiplier effects arising through material purchases and income-induced household purchases resulted in an indirect demand-side impact on GDP of $146 million (including indirect-tax increases).

Estimating the effects of VU on productivity in 2013 required an analysis of the entire period that VU had been operating in Western Melbourne as part of the university sector. This is because a significant portion of those who gained their awards from VU's Western Melbourne campuses in earlier years were still living and working in the region in 2013 and a substantial portion of the research knowledge accumulated over the entire period was still assisting industry productivity in 2013. The study therefore involved forming detailed estimates of the 2013 accumulated stock of human capital and research knowledge, and then estimating how much of the accumulated knowledge would not have been in Western Melbourne if it had not been for VU's presence in the region.

In Section 3.2.1.1 we outlined the detailed procedure for estimating the number of higher education and VET completions from Western Melbourne campuses in each year since 1992 and for each of these cohorts track the number of award holders remaining and working in the region over the period to 2013. The mobility estimates were performed using graduate destination, census data and other information from the literature. We then undertook the same exercise for the counterfactual of Western Melbourne residents obtaining their degrees from Melbourne campuses outside the West. It was assumed under the counterfactual that a loss of attachment to the West from studying in other parts of Melbourne led to a lower rate (based on US literature) of award holders remaining in the region. This exercise was performed under the alternative scenarios of: (i) an unchanged tertiary participation rate of Western Melbourne residents under the counterfactual; and (ii) a 5 per cent reduction in tertiary participation due to the absence of local campuses, based on econometric findings in the literature (see Section 3.3). The impacts reported at the top of this Section are based on the latter assumption.

In order to compute the labour productivity implications of the higher number of award holders working in Western Melbourne it was necessary to apply to these numbers estimates of wage premiums due to knowledge acquired from studying at VU. The wage-premium estimates were formed on the basis of estimates for different levels of higher education and VET awards from the literature.

A similar exercise was carried out to estimate the addition to the accumulated stock of research knowledge in Western Melbourne industries due to the presence of local VU campuses. This was undertaken under the assumption of a 10 per cent rate of decay in research knowledge and an 80 per cent interregional spill-out in research knowledge. The productivity improvement in Western Melbourne industries in 2013 were estimated on the basis of a 30 per cent rate of return on university-generated research knowledge (formed on the basis of relevant econometric literature).

Altogether the increase in productivity generated by VU's presence in Western Melbourne led to a direct increase in Western Melbourne GDP of $80 million and a further indirect increase in GDP of almost $38 million.

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APPENDICES

Appendix A: TERM Regions

Table A1: TERM-WM regions

	TERM-WM Region	Component regions (S/T, SD, SLA and LGA spatial areas)*
1	Western Melbourne	Brimbank (Keilor, Sunshine)
		Hobsons Bay (Altona, Williamstown)
		Maribyrnong
		Melton
		Moonee Valley (Essendon, West MV)
		Wyndham
2	Inner Melbourne	Melbourne (CBD, S'bank-D'lands, Melbourne City remainder)
		Port Phillip (St Kilda, West)
		Yarra (North, Richmond)
3	Outer South East	Frankston
		Greater Dandenong City
		Cardinia[#] (North, Pakenham, South)
		Casey[#] (Berwick, Cranbourne, Hallam, South Casey)
4	Rest of Melbourne	Hume (Broadmeadows, Craigieburn,Sunbury)
		Moreland (Brunswick, Coburg, North Moreland)
		North Middle - (Heidelberg, North, Northcote, Preston)
		Northern Outer (Nillumbik, Whittlesea)
		Boroondara (Camberwell, Hawthorn, Kew)
		Eastern Middle(Manningham, Monash, Whitehorse)
		Eastern Outer(Croydon, Knox, Ringwood)
		Yarra Ranges
		Southern Melbourne(Brighton, Caulfield,
		Kingston, South Bayside, South Glen Eira, Stonningham)
		Mornington Peninsula Shire
5	Rest of Victoria	All Victorian statistical divisions outside the Melbourne SD
6	Rest of Australia	NSW, Queensland, South Australia, WA, Tasmania, ACT, NT

* ABS spatial area acronyms: S/T state and territory; SD statistical division; SSD statistical subdivision; SLA statistical local area; and LGA local government area.

The six regions of the TERM-WM are defined in Table A1 above. Component regions for the first three TERM-WM regions are statistical local areas (SLAs).[67] Where there is more than one SLA within a local government area (LGA), the SLAs are placed in brackets after the LGA name. For instance, Brimbank LGA contains two SLAs: 1181 (Brimbank – Keilor) and

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[67] See ABS (2002) for details of the classification of Australia's geographical regions.

1182 (Brimbank – Sunshine. We write this in Table A1 as Brimbank (Keilor, Sunshine). In the case of Region 4, Rest of Melbourne, the component regions are statistical subdivisions (SSDs), with the names in brackets being their component SLAs and/or LGAs.

Table A2 below shows journey to work data for: (a) the all-industries total; and (b) the Higher Education industry. Note that the figures are for the ABS definition of employment, and thus will include casual workers.

Table A2: Journey to Work ('000 persons)

(a) All Industries							
		Region of Residence					
		1 WestMelb	2 InnerMelb	OuterSEMelb	4 RestMelb	5 RestVic	6 RoA	Total
Region of employment	1 WestMelb	192.0	7.2	2.9	49.1	16.2	-	267.5
	2 InnerMelb	114.1	117.0	29.5	335.4	19.9	-	615.8
	3 OuterSEMelb	2.1	2.2	163.4	65.2	4.5	-	237.5
	4 RestMelb	57.0	34.6	103.3	830.8	19.5	-	1,045.2
	5 RestVic	6.1	1.2	3.1	7.7	641.0	-	659.0
	6 RoA	-	-	-	-	-	8,539.7	8,539.7
	Total	371.3	162.3	302.1	1,288.2	701.0	8,539.7	11,364.7

Table A2: Higher Education Industry							
		Region of Residence					
		1 WestMelb	2 InnerMelb	OuterSEMelb	4 RestMelb	5 RestVic	6 RoA	Total
Region of employment	1 WestMelb	2.0	0.3	0.0	0.9	0.3	-	3.5
	2 InnerMelb	2.6	3.8	0.5	9.8	0.6	-	17.3
	3 OuterSEMelb	0.0	0.0	0.3	0.3	0.0	-	0.6
	4 RestMelb	0.9	1.5	1.4	14.3	0.3	-	18.5
	5 RestVic	0.1	0.1	0.0	0.1	5.3	-	5.6
	6 RoA	-	-	-	-	-	120.1	120.1
	Total	5.6	5.7	2.2	25.4	6.6	120.1	165.5

Source: ABS, Journey to Work Table Builder

Appendix B: Detailed Results

B.1 Demand-side results – all regions

B.1.1 Regional Effects of VU's Western Melbourne campuses
(percentage change)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
Real GDP	1.46	-0.11	-0.13	-0.14	0.06	-0.02	0.00
Real Private Consumption	0.72	-0.03	-0.09	-0.05	0.07	-0.03	0.00
Real Public Consumption	0.72	-0.03	-0.09	-0.05	0.07	-0.03	0.00
Real Investment	2.62	-0.18	-0.26	-0.23	0.12	-0.05	0.00
Employment	1.64	-0.17	-0.12	-0.18	0.05	-0.02	0.00
Capital Stock	1.65	0.00	-0.17	-0.11	0.10	-0.04	0.00

B.1.2 Regional Effects of VU's Western Melbourne campuses
(percentage change relative to counterfactual)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
1 Agriculture, forestry & fishing	-0.66	0.07	0.05	0.08	-0.02	0.01	0.00
2 Mining	-0.31	0.03	0.03	0.04	-0.01	0.00	0.00
3 Manufacturng	-0.53	0.06	0.04	0.10	-0.01	0.01	0.00
4 Electricity, gas, water & waste services	0.12	0.01	-0.02	0.00	0.01	0.00	0.00
5 Construction	1.95	-0.08	-0.24	-0.06	0.19	-0.05	0.00
6 Wholesale trade	-0.02	0.01	0.01	0.02	0.01	0.00	0.00
7 Retail trade	0.22	0.01	-0.01	0.02	0.02	-0.01	0.01
8 Accommodation & food services	2.37	-0.49	-0.50	-0.49	0.09	-0.04	-0.01
9 Transport, postal and warehousing	-0.26	0.02	-0.02	0.00	0.01	0.00	-0.01
10 Information Media & telecommunications	0.16	0.04	0.00	0.01	0.03	-0.01	0.00
11 Financial & insurance services	-0.26	0.12	0.02	0.09	0.03	-0.03	0.00
12 Rental, hiring & real estate services	0.71	0.01	-0.07	0.01	0.08	-0.03	0.00
13 Dwellings	2.72	-0.14	-0.37	-0.23	0.27	-0.10	-0.01
14 Professional, scientific & tech. services	-0.12	0.13	0.00	0.08	0.05	-0.03	0.00
15 Administrative & support services	-0.32	0.07	0.03	0.08	0.03	-0.01	0.00
16 Public administration & safety	0.00	0.18	0.00	0.10	0.08	-0.03	-0.01
17 School & other non-tertiary education	0.20	0.01	-0.04	0.02	0.07	-0.02	0.00
18 Technical and vocational education	-0.51	-3.67	-4.21	-6.06	0.03	0.00	0.01
19 Higher education	100.00	-7.81	-7.41	-5.85	0.00	-0.01	0.02
20 Health care & social assistance	0.35	0.13	-0.08	-0.02	0.07	-0.02	0.00
21 Arts & recreation services	0.28	0.02	-0.10	-0.03	0.06	-0.01	0.00
22 Othe services	1.17	-0.27	-0.11	-0.16	0.04	-0.01	0.00

B.2 Supply-side results – all regions

Table B.2.1 Supply-side regional impacts of VU's Western Melbourne campuses

(percentage change)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
Real GDP	0.29	-0.04	-0.05	-0.05	0.00	0.00	0.00
Real Private Consumption	0.06	-0.01	-0.02	-0.02	0.00	0.00	0.00
Real Public Consumption	0.06	-0.01	-0.02	-0.02	0.00	0.00	0.00
Real Investment	0.25	-0.04	-0.07	-0.06	-0.01	0.00	0.00
Employment	0.00	0.00	-0.01	-0.01	0.00	0.00	0.00
Capital Stock	0.25	-0.03	-0.06	-0.05	0.00	0.00	0.00

Table B.2.2 Supply-side regional impacts on industry output and employment

(percentage change relative to counterfactual)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
1 Agriculture, forestry & fishing	0.38	-0.04	-0.04	-0.04	0.00	0.00	0.00
2 Mining	0.18	-0.02	-0.02	-0.02	0.00	0.00	0.00
3 Manufacturng	0.47	-0.08	-0.08	-0.08	-0.01	0.00	0.00
4 Electricity, gas, water & waste services	0.22	-0.03	-0.04	-0.03	0.00	0.00	0.00
5 Construction	0.36	-0.06	-0.07	-0.07	-0.01	0.00	0.00
6 Wholesale trade	0.23	-0.02	-0.04	-0.04	0.00	0.00	0.00
7 Retail trade	0.26	-0.04	-0.05	-0.05	0.00	0.00	0.00
8 Accommodation & food services	0.26	-0.05	-0.05	-0.05	0.00	0.00	0.00
9 Transport, postal and warehousing	0.33	-0.05	-0.06	-0.05	-0.01	0.00	0.01
10 Information Media & telecommunications	0.34	-0.03	-0.04	-0.03	0.01	0.00	0.00
11 Financial & insurance services	0.35	-0.03	-0.04	-0.03	0.01	0.01	0.00
12 Rental, hiring & real estate services	0.40	-0.05	-0.06	-0.06	0.00	0.00	0.00
13 Dwellings	0.22	-0.04	-0.07	-0.06	-0.01	0.00	0.00
14 Professional, scientific & tech. services	0.54	-0.04	-0.06	-0.05	0.01	0.00	0.00
15 Administrative & support services	0.56	-0.06	-0.07	-0.07	0.00	0.00	0.00
16 Public administration & safety	0.33	-0.06	-0.05	-0.05	0.00	0.00	0.00
17 School & other non-tertiary education	0.18	-0.03	-0.03	-0.03	-0.01	0.00	0.00
18 Technical and vocational education	0.57	-0.06	-0.06	-0.07	0.00	0.00	0.00
19 Higher education	0.00	-0.07	-0.07	-0.06	0.00	0.00	0.00
20 Health care & social assistance	0.19	-0.06	-0.02	-0.03	-0.01	0.00	0.00
21 Arts & recreation services	0.32	-0.04	-0.04	-0.04	0.00	0.00	0.00
22 Othe services	0.27	-0.05	-0.04	-0.04	0.00	0.00	0.00

B.3 Total impact on all regions of VU's Western Melbourne campuses

Table B.3.1 Total regional impacts of VU's Western Melbourne campuses
(percentage change)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
Real GDP	1.75	-0.15	-0.18	-0.19	0.06	-0.02	0.00
Real Private Consumption	0.78	-0.05	-0.11	-0.07	0.07	-0.03	0.00
Real Public Consumption	0.78	-0.05	-0.11	-0.07	0.07	-0.03	0.00
Real Investment	2.87	-0.22	-0.33	-0.29	0.12	-0.05	0.00
Employment	1.63	-0.17	-0.12	-0.18	0.05	-0.02	0.00
Capital Stock	1.90	-0.04	-0.23	-0.16	0.10	-0.04	0.00

Table B.3.2 Total regional impacts of VU's Western Melbourne campuses on industry output
(percentage change relative to counterfactual)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
1 Agriculture, forestry & fishing	-0.28	0.03	0.01	0.04	-0.01	0.01	0.00
2 Mining	-0.12	0.01	0.00	0.02	-0.01	0.00	0.00
3 Manufacturng	-0.06	-0.01	-0.04	0.02	-0.02	0.00	0.00
4 Electricity, gas, water & waste services	0.35	-0.02	-0.06	-0.03	0.00	0.00	0.00
5 Construction	2.30	-0.14	-0.32	-0.13	0.18	-0.05	0.00
6 Wholesale trade	0.21	-0.01	-0.03	-0.01	0.01	0.00	0.00
7 Retail trade	0.47	-0.03	-0.06	-0.04	0.02	-0.01	0.01
8 Accommodation & food services	2.64	-0.54	-0.55	-0.53	0.09	-0.03	0.00
9 Transport, postal and warehousing	0.07	-0.03	-0.08	-0.05	0.01	0.00	0.00
10 Information Media & telecommunications	0.50	0.01	-0.03	-0.02	0.04	-0.01	0.00
11 Financial & insurance services	0.10	0.09	-0.02	0.06	0.04	-0.03	0.00
12 Rental, hiring & real estate services	1.12	-0.04	-0.13	-0.04	0.08	-0.03	0.00
13 Dwellings	2.94	-0.18	-0.44	-0.29	0.25	-0.10	0.00
14 Professional, scientific & tech. services	0.42	0.08	-0.06	0.03	0.06	-0.03	0.00
15 Administrative & support services	0.25	0.01	-0.05	0.01	0.04	-0.01	0.00
16 Public administration & safety	0.33	0.11	-0.05	0.05	0.07	-0.03	-0.01
17 School & other non-tertiary education	0.38	-0.02	-0.06	-0.01	0.06	-0.02	0.00
18 Technical and vocational education	0.06	-3.73	-4.27	-6.13	0.03	0.00	0.01
19 Higher education	100.00	-7.88	-7.48	-5.91	0.00	0.00	0.02
20 Health care & social assistance	0.54	0.07	-0.11	-0.05	0.07	-0.02	0.00
21 Arts & recreation services	0.60	-0.02	-0.14	-0.07	0.06	-0.01	0.00
22 Othe services	1.44	-0.32	-0.15	-0.20	0.04	-0.01	0.00

B.4 Total impact on all regions of VU's Western Melbourne campuses – alternative scenario

Table B.4.1 Total regional impacts of VU's Western Melbourne campuses - alternative scenario
(percentage change)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
Real GDP	1.79	-0.12	-0.14	-0.15	0.07	-0.02	0.01
Real Private Consumption	0.80	-0.03	-0.09	-0.05	0.08	-0.03	0.01
Real Public Consumption	0.80	-0.03	-0.09	-0.05	0.08	-0.03	0.01
Real Investment	2.93	-0.19	-0.28	-0.24	0.13	-0.04	0.01
Employment	1.63	-0.17	-0.12	-0.18	0.05	-0.02	0.00
Capital Stock	1.95	-0.01	-0.19	-0.12	0.11	-0.03	0.01

Table B.4.2 Total regional industry impacts - alternative scenarios
(percentage change relative to counterfactual)

	Western Melbourne	Inner Melbourne	Outer SE Melbourne	Rest of Melbourne	Rest of Victoria	Rest of Australia	Australia
1 Agriculture, forestry & fishing	-0.24	0.06	0.04	0.07	-0.01	0.01	0.00
2 Mining	-0.10	0.03	0.02	0.04	0.00	0.01	0.01
3 Manufacturng	-0.01	0.03	0.01	0.06	-0.01	0.00	0.01
4 Electricity, gas, water & waste services	0.37	0.00	-0.03	-0.01	0.01	0.00	0.01
5 Construction	2.37	-0.10	-0.26	-0.07	0.20	-0.04	0.01
6 Wholesale trade	0.24	0.01	0.00	0.01	0.01	0.00	0.01
7 Retail trade	0.50	-0.01	-0.04	-0.01	0.03	0.00	0.02
8 Accommodation & food services	2.68	-0.51	-0.51	-0.50	0.10	-0.03	0.01
9 Transport, postal and warehousing	0.11	0.01	-0.05	-0.02	0.01	0.00	0.00
10 Information Media & telecommunications	0.53	0.03	-0.01	0.00	0.04	-0.01	0.01
11 Financial & insurance services	0.14	0.12	0.01	0.09	0.04	-0.02	0.01
12 Rental, hiring & real estate services	1.17	0.00	-0.08	0.00	0.09	-0.02	0.01
13 Dwellings	3.01	-0.13	-0.37	-0.22	0.29	-0.08	0.02
14 Professional, scientific & tech. services	0.47	0.12	-0.01	0.07	0.07	-0.03	0.01
15 Administrative & support services	0.30	0.05	-0.01	0.05	0.04	-0.01	0.01
16 Public administration & safety	0.36	0.14	-0.03	0.07	0.08	-0.02	0.00
17 School & other non-tertiary education	0.40	0.00	-0.05	0.01	0.07	-0.02	0.01
18 Technical and vocational education	0.11	-3.70	-4.24	-6.09	0.04	0.00	0.02
19 Higher education	100.00	-7.85	-7.45	-5.88	0.00	-0.01	0.03
20 Health care & social assistance	0.56	0.08	-0.09	-0.04	0.07	-0.02	0.01
21 Arts & recreation services	0.62	0.00	-0.12	-0.05	0.06	-0.01	0.01
22 Othe services	1.47	-0.30	-0.13	-0.18	0.05	-0.01	0.01