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J. Nassios[1], J. A. Giesecke, P. B. Dixon, M. T. Rimmer

Abstract

Most Australian state and territory governments levy land tax on unimproved land value. The principal place of residence (PPR) is however exempt. In this article, we study the allocative efficiency impact of this exemption in one Australian state (New South Wales). Our simulation-based analysis utilises a multi-regional computable general equilibrium (CGE) model, which is calibrated using a discrete choice model of housing tenure choice. Using excess burden and economic damage measures, we illustrate how the PPR exemption is responsible for the majority of the efficiency differences between a broad-based land tax, and NSW state land tax.

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[1] Please direct all correspondence to Jason Nassios, Centre of Policy Studies, Victoria University, 300 Flinders St, Melbourne, VIC 3000 Australia. Email: Jason.Nassios@vu.edu.au

1 Introduction

The design of a fair and resilient tax system that enhances economic prosperity has been a central public policy agenda item in Australia for many years, with discussion of tax design issues evident in the 1915 Australian income tax policy debate [Stewart (2015); Commonwealth Parliament (1915)]. Australia's most comprehensive review of state and federal tax policy, the recent Henry Review of Australia's Future Tax System (2009), made several recommendations to promote resilience, fairness, and prosperity. Among these, the review identified heightened reliance on land tax and a reduction in property transfer duty as being key elements of future tax reforms. This remains a key agenda item in Australia's ongoing tax reform debate [Freebairn (2018a)].

The first documented discussion of land taxation by state governments in Australia can be traced back to Henry Melville's account of early Tasmanian history [Melville (1835); Else-Mitchell (1974); Smith (2004)]. In the decades that followed, the merits of landowner taxation was formalised by Mill (1848), who built on previous work by Smith (1776) and Ricardo (1817). These studies, together with strong political interest in land tax fostered by George (1879), helped shape the Australian tax reform debate [Smith (2004)]. In 1884, this debate turned to action as the South Australian state government imposed Australia's first land tax [Taxation Act (1884); Smith (2004); Ingles (2016)]. This tax was viewed as an efficient means to address revenue shortfalls from flagging crown land sale revenues [Smith (2004)]; and as a way to address land wealth concentration, by encouraging landholders to subdivide their estates [Smith (2005)].

Other state governments followed South Australia's lead: New South Wales (NSW) legislation was passed in 1895, followed by Western Australia (1907), Victoria and Tasmania (1910) and Queensland (1915) [Smith (2005)]. State land taxes were however short-lived. The NSW state government system, for example, was largely abolished in 1906, to remove competition for land tax revenues between the NSW state government and local councils [Local Government Act (1906)].

In 1910, the Federal Government introduced the Land Tax Assessment Act (1910), which was Australia's first federally imposed land tax. This system remained in place for over four decades. However, following significant income tax reforms to fund Australia's Second World War efforts (including centralising the imposition and collection of income tax), the federal land tax was removed in 1952 [Smith (2005)]. Following the removal of federal land tax, the NSW government reintroduced a broad-based land tax in 1956 [Land Tax Act (1956); Smith (2005)]. Over the ensuing years, the tax base narrowed as NSW primary producers lobbied for land tax rebates, which increased from 15 per cent in 1967 to 60% by 1970. In 1970, primary production land was declared formally exempt from NSW state land tax [Land Tax (Amendment) Act (1970)]. These amendments are today referred to as the primary producer land (PPL) exemption. The PPL exemption was followed in 1973 by the exemption of principal place of residence land not exceeding 2100 square metres in area [Land Tax (Amendment) Act (1973)]. This exemption was extended to allotments exceeding 2100 square meters by the Land Tax Management (Amendment) Act (1992), via the introduction of a special exemption. We refer to this as the principal place of residence (PPR) exemption.

The purpose of this paper is to explore the economic effects of the PPR exemption. We do this by comparing the economic effects of two kinds of land tax in NSW:

(i) Local council rates on unimproved land value (UIV), the system of council taxation currently in operation in NSW; and,

(ii) State Government land tax in NSW.

In this paper, we approach the problem of assessing the relative efficiency of different state and federal taxes, such as council rates and state land tax, as a multi-agent constrained optimisation problem. The many equations that arise from the identification and co-dependence of many economic agents, e.g., cost-minimising industries that operate in each region subject to constant-returns-to-scale (CRS) production functions and so forth, comprise a bottom-up multi-regional computable general equilibrium (CGE) model of Australia's states and territories. This CGE model is called the Victoria University Regional Model with Tax detail, or VURMTAX hereafter.

As we shall describe, VURMTAX identifies two levels of government. Each state/territory in the model has a region-specific government, levying council rates, land tax, payroll tax, conveyancing duties and other state and local government taxes. A single federal government operates across all states and territories, levying corporate tax, personal income tax, goods and services tax, and a number of other federal taxes.[2] This level of state-specific fiscal detail allows targeted analysis of the types of tax reform recommendations in the Henry Review (2009), and region-specific analysis of the impact of exemptions, e.g., the PPR exemption from state land tax. Herein, we exploit this detail in VURMTAX to elucidate the economic impact of changes in state land tax and local council rates in one Australian state: NSW. We focus on NSW because it is one of a handful of states where council rates are levied purely on unimproved land values (UIV).[3]

The key distinction between NSW state land taxes and local council rates on UIV are exemptions. Local councils typically levy differentiated rates based on land zone types, but they carry very few exemptions [Henry Review (2009)]. In contrast, as discussed by Freebairn (2016), the NSW state land tax has two sources of inefficiency relative to a broad-based land tax: (1) Exemptions, which include the PPL and PPR exemption [see the Land Tax (Amendment) Act (1970, 1973)], in addition to exemptions for land held by charities, municipal and public land, health centres, and residential care facilities; and (2) Higher tax rates apply to larger land holdings. The state land tax system was originally designed to encourage rural holders of large parcels to subdivide their allotments [Smith (2004, 2005)]. For this reason it is sometimes argued that the land tax system in NSW, and other Australian states, is responsible for a large proportion of rental apartments being individually rather than institutionally owned. There is some support in the literature from a small number of US studies that differences in ownership structure might affect the efficiency of renting activities. For example, Haddin III (2009) finds that, for multifamily homes in the city of Atlanta, the operating performance of properties owned by real estate investment trusts (REITs) is slightly better than that for non-REIT-owned properties. This result, however, is not readily translatable to the NSW ownership issue.

The PPR exemption from state land tax represents the clearest distortion arising from the NSW land tax system. Assessing the economic impact of the NSW PPR exemption is therefore the key focus of this paper. Determining whether other features of the state land tax system (in particular, the tax-free threshold, the premium rate, and the application of these by total land holdings of an owner rather than

[2] For a description of the GST theory in VURMTAX, and how GST differentially affects state and local governments, see Giesecke and Tran (2018).

[3] As noted by Freebairn *et al.* (2015), the others are Queensland, the Northern Territory and the ACT.

on individual land parcels) lead to significant distortions, would require extensive data on individual landholders and their properties. These data are not available, thus we do not consider these additional potential sources of allocative inefficiency herein.

The remainder of this paper is structured as follows. We begin with an overview of land tax modelling in VURMTAX in section 2. Section 2.1 discusses NSW local council rates. Section 2.2 describes how the PPR exemption from state land tax is modelled in VURMTAX with the aid of a discrete choice model of the household's own-versus-rent decision problem. Section 2.3 describes a neoclassical analogue of this discrete choice model which is embedded within VURMTAX's multi-agent optimisation framework. Section 3.4 presents formulae describing excess burden measurement in VURMTAX. Section 4 describes our simulations and results. Section 5 concludes the paper.

2 Modelling land taxes in VURMTAX

VURMTAX identifies 76 industries operating within 8 regions. We denote the set of industries IND and the set of regions REG. VURMTAX identifies four types of land tax potentially levied on land used in each industry in each region: (1) Local council rates on UIV. We denote the value of these taxes levied on land in industry *i* in region *q* as $V1LNDTXL_{(i,q)}$; (2) State land tax ($V1LNDTXS_{(i,q)}$); (3) Other state taxes on immovable land ($V1LNDTXSO_{i,q}$); and (4) Federal land tax ($V1LNDTXF_{(i,q)}$).

In this paper we focus on local council rates ($V1LNDTXL_{(i,q)}$) and state land taxes ($V1LNDTXS_{(i,q)}$). As discussed earlier, the federal government does not levy land tax, hence $V1LNDTXF_{(i,q)} = 0$. The remaining item ($V1LNDTXSO_{(i,q)}$) is aggregate revenue from miscellaneous state taxes on unimproved land value. These include taxes like the Western Australian Metropolitan Region Improvement Tax, which we do not consider in this paper.

All land tax rates in VURMTAX are expressed as tax rates on land income, $V1LND_{(i,q)}$, derived from land employed by industry *i* in region *q* rather than land values.[4] We calculate initial land tax rates on income from land used in industry *i* operating in region *q* via:

[4] Alternatively, we could explicitly solve for land values, and apply land tax rates to land values, by discounting regional industry land rents by appropriate discount rates. Our approach (applying tax rates to land rents) is equivalent to taxing land values in cases where discounts rates can be assumed to be independent of the policy under investigation.

$$\text{TAXLNDL}_{(i,q)} = \frac{\text{V1LNDTXL}_{(i,q)}}{\text{V1LND}_{(i,q)}},$$
$$\text{TAXLNDS}_{(i,q)} = \frac{\text{V1LNDTXS}_{(i,q)}}{\text{V1LND}_{(i,q)}}. \quad (1)$$

In a standard business-as-usual forecast, all land tax rates in VURMTAX defined in equation (1) are held exogenous at the levels implied in our initial data.[5] All tax policy simulations conducted herein involve an event-year change in the tax rates defined by equation (1). In the following sections, we provide more detail regarding the parameterisation of the initial land tax data arrays for council rates (V1LNDTXL) and state land tax (V1LNDTXS) in NSW.

2.1 Local council rates in NSW

Within the framework described in section 2, council rates are distinguished from other land taxes in two ways:

1. The breadth of the tax base. That is, which industries are exempt from paying local council rates?
2. The rate of the tax. Higher charges may be imposed on different sub-categories, such as industrial land, CBD properties, and certain urban centres.

In NSW, council rates are levied property-by-property, on a UIV basis. This distinguishes NSW council rates from Victorian, West Australian, South Australian and Tasmanian council rates, which are levied on either capital improved or site values. The NSW Officer of the Valuer General determines UIV. Rate structures are set by individual councils to raise sufficient revenue to cover their expenditure assignment; however, rates are pegged in accordance with the Local Government Act, so that revenue does not grow faster than a given rate. Councils usually charge different rates to different categories of property. For example, commercially-zoned land typically attracts a higher rate than residential property or primary producer land, these being the major categories of property for council rates.

As discussed in section 1, local council rates act like state land taxes, with the exception that there are a different set of exemptions. In particular, PPL and PPR are subject to council rates. Because council

[5] All key tax revenues rely on ABS Taxation Statistics data in ABS Cat. No. 5506.0 for 2015/16.

rates are payable on virtually all residential properties, there is no direct housing tenure choice distortion generated by local council rates levied on a UIV-basis.

We use data from ABS Cat. No. 5512.0 to calibrate VURMTAX. This records total NSW council rate revenue of $4,169 m. in 2015/16.[6] We distribute this across industries using shares in Page (2011), which states that 65% of NSW council rate collections are from residential property, while rates on business and PPL account for 25% and 7% of collections. The remaining 3% of collections were classified as *other rate sources*. We distribute this *Other source* revenue across residential, business and primary production. Thus, VURMTAX models NSW as deriving 67% of council rate collections from residential properties, and 26% and 7% from business and farmland.

2.2 Modelling the deadweight loss caused by the PPR exemption from state land tax

As described in section 2.1 and discussed by Freebairn (2018b), an important distinction between land tax and council rates is the PPR exemption. This exemption can cause allocative efficiency distortions. In this section we provide a framework for understanding the impact on resource allocation of the PPR land tax exemption. We do this via a discrete choice model of the household's own-versus-rent decision (see section 2.2.1). This elucidates how the PPR exemption biases home tenure choice away from renting and towards ownership. We then allow for this tenure bias in VURMTAX by using an appropriately calibrated neoclassical analogue of the discrete choice model (see section 2.2.2).

2.2.1 Own or rent? A discrete choice model

Consider a family-unit *j* that has a choice between satisfying its principal dwelling requirements by either owning or renting. We represent unit *j*'s utility function [*U*(*j*)] as

$$U(j) = D(j) * U\left(\frac{X_1(j)}{A_1(j)}, Z(j)\right) + (1 - D(j)) * U\left(\frac{X_2(j)}{A_2(j)}, Z(j)\right), \qquad (2)$$

where

[6] Table 1 NSW Local Government General Operating Statement, Government Finance Statistics, Australia 2015-16 (cat. no. 5512.0).

$X_1(j)$ and $X_2(j)$ are the quantity of tax-free owner-occupied dwelling services and taxed rental dwelling services used by j;

$Z(j)$ is the quantity of all other goods used by j;

$D(j)$ is a dummy variable that has the value one if j choses to own and zero if j choses to rent ; and

$A_1(j)$ and $A_2(j)$ are j's preference variables for owning and renting.

A high value for $A_1(j)$ relative to $A_2(j)$ means that j is likely to be a renter: a high value for $A_1(j)$ means that owning is an inefficient way of generating utility for j.

Denote the annual cost of using land as an owner by P_1 and the annual cost of using land as a renter by P_2. Assume that P_1 and P_2 are given by:

$$P_1 = P*(1+T_1), \tag{3}$$

$$P_2 = P*(1+T_2), \tag{4}$$

where T_1 and T_2 are the tax rates applying to owner and rental land.

From (2), (3) and (4) we conclude that:

Market condition

j will be a renter if $$A_1(j) \geq A_2(j)*(1+T_2)/(1+T_1); \tag{5}$$

j will be an owner if $$A_1(j) < A_2(j)*(1+T_2)/(1+T_1). \tag{6}$$

We assume dwelling services are homogeneous. Then for an optimal distribution of dwelling services between owned and rented varieties:

Efficiency condition

j must be a renter if $A_1(j) \geq A_2(j);$ (7)

j must be an owner if $A_1(j) < A_2(j).$ (8)

Why are equations (7) and (8) an efficiency condition? As can be seen from (2), if j is an owner and was given $[A_2(j)/A_1(j)]*X_1(j)$ units of rented dwelling services in exchange for $X_1(j)$ units of owned dwelling services, then there would be no change in j's utility. Now assume $A_1(j) > A_2(j)$; then, we would have some resources left over (a welfare gain). Hence, if there is an owner with $A_1(j) > A_2(j)$, then the situation is sub-optimal.

Comparing (5) and (6) with (7) and (8), we see that the market will produce an optimal outcome if and only if T_1 is equal to T_2. In NSW, the land tax PPR exemption drives T_1 to zero, while a reasonable value for T_2 is 0.17.[7] With these tax rates, we see that there is likely to be an under-use of dwelling services for renting and an over-use for owning.

Figure 1 depicts the distribution of dwelling services across owners and renters. In Figure 1, we assume that all family units have A_1 and A_2 values that sum to 3 and that both A_1 and A_2 lie between 1 and 2. We also assume that if $T_1 = T_2$ then $A_1 = 1.5 = A_2$, i.e., there would be a 50/50 split between owners and renters.[8] With $(1+T_1)/(1+T_2) = 1/1.17$, in the market outcome all households j whose A_2 value is greater than 1.38 will be owners. As indicated in the figure, family units whose A_2 value is between 1.38 and 1.5 will be owners under market conditions whereas optimality requires that they should be renting.

To calculate the efficiency impact of removing a land tax on rented housing, we need to determine how much dwelling services is consumed by people whose A_2 value is between 1.38 and 1.5.

We assume that the preference variable A_2 is spread according to a rectangular distribution across its range 1 to 2, and that in the initial market situation, each j uses sufficient dwelling services to give a value of 1 for its argument in its utility function. If j is a renter then j's use of dwelling services is $A_2(j)$. If j is an owner then j's use of dwelling services is A_1(j). Now we can calculate that the dwelling services used by renters in the initial situation is:

$$X_2^{market} = \int_1^{1.38} A_2 * dA_2 = 0.46. \qquad (9)$$

The amount of dwelling services used by owners who should be renters is:

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[7] This is based on the idea of an approximately 3.2 per cent rate of return on dwellings, and a 1.6 per cent tax rate applied to the value of land. When weighted by an appropriate share of land-to-capital costs incurred in delivering a unit of dwellings services in Australia, e.g., 0.33, this yields our assumed relative tax rate of 0.17.

[8] Some evidence in favour of a 50/50 split between owners and renters can be found in the survey of owner-occupied housing taxes in Europe by van der Hoek and Radloff (2007). They find that, with no owner-occupied tax breaks, France exhibits a home ownership rate of 54.8%, which is very close to our assumption of 50%.

$$X_1^{misallocated} = \int_{1.5}^{1.62} A_1 * dA_1 = 0.18. \tag{10}$$

The amount of dwelling services used by owners who should be owners is:

$$X_1^{optimal} = \int_{1}^{1.5} A_1 * dA_1 = 0.625. \tag{11}$$

The total amount of dwelling services used by owners under the prevailing market conditions is:

$$X_1^{market} = X_1^{misallocated} + X_1^{optimal} = 0.81. \tag{12}$$

The total amount of dwelling services used by owners and renters in the market solution is:

$$X^{market} = X_1^{market} + X_2^{market} = 1.26. \tag{13}$$

Because the owner/rental split is assumed to be 50/50 in the absence of the PPR distortion, the total amount of dwelling services used in an optimal solution is:

$$X^{optimal} = 2 * X_1^{optimal} = 1.25. \tag{14}$$

The excess burden associated with tax-related misallocation of dwelling services, calculated as excess resource use, is:

$$X^{market} - X^{optimal} = 0.0135. \tag{15}$$

Thus, the market induces a 1.08 per cent [=100*(0.0135/1.25)] excessive use of dwelling services.

How much tax is collected by the 17% tax on rent use? Assume the tax-free price of land is 1. Then:

$$\text{Tax revenue} = 0.17 * 0.46 = 0.077. \tag{16}$$

Under optimal conditions, land requirements are satisfied via an expenditure of 1.25 units. Imposing the 17% tax from the optimal position costs consumers 0.077 in tax plus 0.0135 in misallocated expenditure between renting and owning. Thus, the average excess burden (AEB, calculated as the ratio of aggregate deadweight loss to aggregate tax collections on misallocated capital) is:

$$AEB = \frac{0.0135}{0.077} = 17.6\%. \tag{17}$$

2.2.2 *A neoclassical representation*

According to the discrete-choice analysis in section 2.2.1, removing land tax on rented housing increases the X_2 / X_1 ratio from 0.45 / 0.81 to 0.625 / 0.625, i.e. from 0.567 to 1. This is caused by a change in relative prices from 1.17/1 to 1. These observations are consistent with a representative agent utility-maximizing model in which the utility function guiding owner-renter choice is given by:

$$UR = \left(X_1^{\sigma-1/\sigma} + X_2^{\sigma-1/\sigma}\right)^{\sigma-1/\sigma}, \tag{18}$$

if we set σ, the elasticity of substitution between owning and renting, equal to 3.66.[9] As we shall describe in section 2.3, this motivates the tenure choice substitution elasticity we use in VURMTAX.

To illustrate this, as in the discrete-choice model, we assume (X_2, X_1) = (0.46, 0.81) in the prevailing market situation; i.e., with the 17 per cent land tax in place so that P_2/P_1 = 1.17. Thus, as shown in Figure 2, total land use in this distorted situation is 1.26 (=0.46+0.81), yielding UR=1.622. Optimally distributed between owning and renting, 1.26 units of land would yield utility of UR=1.639. Alternatively, we could generate the initial level of utility using 1.06 per cent less land [= 100*(1-1.622/1.639)]; that is, using 1.25 units of land distributed as 0.625 for each of owning and renting.

This analysis shows a deadweight loss from the distorting tax of 0.0134 units of land, close to the discrete-choice model value (0.0135). The AEB in the representative-agent model is thus:

$$AEB = \frac{0.0134}{0.077} = 17.4\%, \tag{19}$$

compared with 17.6% for the discrete-choice model [see equation (17)]. As we shall see, the results from both the discrete choice and neoclassical models described in this article are quite similar to the values derived from our CGE model, VURMTAX, when we simulate the removal of land taxes on the NSW dwellings sector (holding all other tax rates constant).

[9] To arrive at an elasticity of substitution equal to 3.66, we solve the representative agent utility maximisation problem described in equation (18) under two exogenous shocks: (1) We remove the relative price distortion between owner occupied and rented dwelling services, by removing the 17 per cent tax on rented dwelling services; and (2) We reduce overall demand for dwelling services by 1.08 per cent, in line with equation (15).

2.3 **Modelling land tax in NSW in VURMTAX**

VURMTAX identifies two dwelling types (low-density and high-density) and two tenure possibilities (ownership or tenancy). This is modelled by first identifying two dwelling industries, distinguished by dwelling type: high density dwellings, and low density dwellings (hereafter *DwellingHigh* and *DwellingLow*). Because each of these industries offers two tenure choices to households, VURMTAX identifies four dwelling service commodities: high-density tenancy (*DwelHighRent*), high-density ownership (*DwelHighOwn*), low-density tenancy (*DwelLowRent*) and low-density ownership (*DwelLowOwn*).[10] We assume that each industry assigns its dwelling services output across the two tenure choices in a constrained revenue-maximising way. More formally, we assume each dwelling production sector (*DwellingHigh* and *DwellingLow*) faces a constrained transformation process (described by industry-specific constant elasticity of transformation (CET) functions) for dividing its output across the tenure choices (respectively, *DwelHighRent* and *DwelHighOwn*, and *DwelLowRent* and *DwelLowOwn*). This establishes the supply side of the market for the four residential service types.

We model dwellings demand as a staged decision process. At the top level of the process, households demand a single commodity *Shelter*, which is undifferentiated by dwelling type or tenure choice. The household's first decision problem is to choose utility maximising consumption of each of 83 commodities, of which *Shelter* is one, taking as given prices and the available consumption budget.[11]

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[10] We use a number of data sources to inform these divisions. ABS 5204.0 (Table 49: income from dwelling rent, current prices) describes the division of the gross operating surplus of the *Ownership of dwellings* sector into actual and imputed rent. For June 2016, total gross rent is recorded as $194,499 m., comprising imputed rent for owner-occupiers of $152,223 m. and actual rent paid by tenants of $42,276 m. Based on these data, a reasonable split of gross operating surplus at the national level between the two tenure choices is 78.3% for owner occupiers and 21.7% for renters. The division of NSW consumption of dwelling services across owners and renters, and across high and low density dwellings, relies on data on NSW occupancy choice and dwelling type from ABS Cat. No. 3240.1, data on house and unit prices from CoreLogic (2017). The resulting division of the initial value of the consumption of *Ownership of dwellings* across the four new dwellings commodities is: high density tenancy, 11%; high density ownership, 9.8%; low density tenancy, 10.7%; and low density ownership, 68.5%. This division produces a split of the value of *Ownership of dwellings* consumption across owners and renters in the proportions 78.3% and 21.7% (consistent with national accounts data), and across low density and high density in the proportions 79.2% and 20.8%. The latter is consistent with values implied by ABS Cat. No. 3240.1 (Housing Choices NSW) and CoreLogic statistics on house and unit prices and rental rates. It is also broadly consistent with NSW housing tenure data from Table 17 of ABS Cat. No. 4130.0, which reports the proportion of NSW households by dwelling type in 2013/14 (viz. separate houses, semi-detached row or terrace houses or town houses, 81.7%; and flats or apartments, 17.8%).

[11] The top level of the consumer's optimization problem covers 83 commodities (comprising VURMTAX's 86 commodities, less the four varieties of housing, plus the aggregate dwellings commodity called *Shelter*). Utility is generated from the 83 commodities via a Klein-Rubin utility function.

Having determined utility-maximising demand for *Shelter* in this way, the household's second problem is to minimise the cost of acquiring *Shelter*, by choosing in a constrained optimising fashion, alternative dwelling types. More formally, we assume that the household views *Shelter* as a constant elasticity of substitution (CES) combination of high- and low-density dwellings. The second stage of the household's decision problem therefore requires the household to minimise the cost of acquiring the utility maximising level of *Shelter* by choosing across two types of dwellings, *DwellingLow and DwellingHigh,* subject to the CES function and given prices. We assume the elasticity of substitution in this second decision to be relatively low and equal to 0.5.

In the final stage of the housing decision problem, households minimise the cost of acquiring the cost-minimising levels of *DwellingLow and DwellingHigh* via a tenure choice decision, e.g., given the cost-minimising level of *DwellingLow* consumption, households minimise the cost of acquiring this by choosing between *DwelLowRent* and *DwelLowOwn*.[12] For the reasons outlined in section 2.2.2, the substitution elasticity in the tenure choice decision is set to 3.66. This establishes the demand side of the market for the four types of residential service (comprising two dwelling types cross-classified by two tenure types). These four markets clear via endogenous movements in prices. As discussed below, for purchases of low- and high-density rental services, these prices include land taxes.

In VURMTAX, state government sales taxes collected on purchases of commodity *c* from source *s* by households in region *q* are represented by $V3TAXS_{(c,s,q)}$. As discussed in Section 1, the PPR is land tax exempt. We use appropriate entries in $V3TAXS_{(c,s,q)}$ to ensure that land tax levied on, for example, the high-density dwelling sector (*DwellingHigh*), is paid by renters (i.e. consumers of *DwelHighRent*) and not owners (i.e. users of *DwelHighOwn*). In simulations in which we change land tax rates, this ensures that changes in land tax collections affect renters, but not owners. The allocation formula recognises that the initial assignment of land taxes in the input-output database is on the production side of the *DwellingHigh* and *DwellingLow* industries. The starting point for the incidence of these taxes, without intervention via entries in V3TAXS(c,s,q), is on both owner-occupiers and renters of

[12] Likewise, households minimise the cost of acquiring their *DwellingHigh* consumption by choosing between *DwelHighRent* and *DwelHighOwn* in a constrained cost-minimising way.

each type of dwelling. In both the initial database and in simulation, we ensure that the land tax is paid by renters but not owners via the following set of equations:

$$\begin{aligned}
V3TAXS_{(DwelHighOwn,NSW,NSW)} &= -S_{(DwellingHigh,NSW)} \times V1LNDTXS_{(DwellingHigh,NSW)}, \\
V3TAXS_{(DwelHighRent,NSW,NSW)} &= +S_{(DwellingHigh,NSW)} \times V1LNDTXS_{(DwellingHigh,NSW)}, \\
V3TAXS_{(DwelLowOwn,NSW,NSW)} &= -S_{(DwellingLow,NSW)} \times V1LNDTXS_{(DwellingLow,NSW)}, \\
V3TAXS_{(DwelLowRent,NSW,NSW)} &= +S_{(DwellingLow,NSW)} \times V1LNDTXS_{(DwellingLow,NSW)},
\end{aligned} \tag{20}$$

where:

$V1LNDTXS_{(k,NSW)}$ is land tax paid on land used in the production of NSW dwelling type *k*;

$S_{(k,NSW)}$ is the share of sales of dwelling type *k* in NSW accounted for by the owner-occupancy tenure choice, calculated via:

$$\begin{aligned}
S_{(DwellingHigh,NSW)} &= \frac{MAKE_{(DwelHighOwn,DwellingHigh,NSW)}}{MAKE_{(DwelHighOwn,DwellingHigh,NSW)} + MAKE_{(DwelHighRent,DwellingHigh,NSW)}}, \\
S_{(DwellingLow,NSW)} &= \frac{MAKE_{(DwelLowOwn,DwellingLow,NSW)}}{MAKE_{(DwelLowOwn,DwellingLow,NSW)} + MAKE_{(DwelLowRent,DwellingLow,NSW)}},
\end{aligned} \tag{21}$$

where:

$MAKE_{(c,i,q)}$ is the value of commodity *c* produced by industry *i* in region *q*; and,

$V3TAXS_{(c,NSW,NSW)}$ is a consumption tax or subsidy paid by households on dwelling service type *c*.

For purchasers of the owner tenure variety, the V3TAXS value will be a subsidy sufficient to eliminate the V1LNDTXS carried in the basic price of the relevant dwelling type. For purchasers of the renter tenure variety, the V3TAXS value will be a tax sufficient to ensure that the purchaser's price reflects all land tax payable on the relevant dwelling type. From (20) and (21), it is clear that the sales tax/subsidy combination are revenue neutral; this revenue neutrality holds throughout our simulation.

3 VURMTAX

This section describes key features of VURMTAX, and outlines how we use the model to calculate tax-specific marginal (MEB) and average excess burden (AEB) estimates. Section 3.1 summarises key features of VURMTAX. Model closure is discussed in section 3.2. Section 3.3 describes valuation of leisure in VURMTAX. The key equations used to calculate the MEB, AEB and state economic damage indicators (SEDIs) are summarised in section 3.4.

3.1 Model description

VURMTAX is a 76-industry model of Australia.[13] Herein, we use a two-region (NSW and the Rest of Australia) aggregation of the core eight-region database. All but six of the industries produce a single commodity. In this paper, the key exceptions are the low-density dwellings and high-density dwellings industries, which each produce two commodities: owner-occupied and rental variants of the output of their respective low-density and high-density dwelling services.

Investment in each regional industry is assumed to be positively related to expected rates of return on capital in each regional industry. VURMTAX recognises two investor classes: local investors (i.e. domestic households and government) and foreign investors. Effective tax rates on each investor class differ, with foreign investors not liable to pay Australian personal income tax on their capital income, while they are also unable to claim back Australian franking credits. Capital creators assemble, in a cost-minimizing manner, units of industry-specific capital for each regional industry. Each region has a single representative household and a state government. The federal government operates in each region. The foreign sector is described by export demand curves for the products of each region, and by supply curves for international imports to each region. Supply and demand for each regionally produced commodity is the outcome of optimising behaviour. Regional industries are assumed to use intermediate inputs, labour, capital and land in a cost-minimising way, while operating in competitive markets. Region-specific representative households purchase utility-maximising bundles of goods, subject to given prices and disposable income. Regions are linked via interregional trade, interregional migration and capital movements, and governments operate within a fiscal federal framework.

VURMTAX provides results for economic variables on a year-on-year basis. The results for a particular year are used to update the database for the commencement of the next year. More specifically, the model contains a series of equations that connect capital stocks to past-year capital

[13] VURMTAX is an extension of the Victoria University Regional (VURM) model, carrying detailed modelling of local, state and federal taxes. Adams *et al.* (2015) provides a detailed description of VURM.

stocks and net investment. Similarly, debt is linked to past and present borrowing/saving, and the regional population is related to natural growth and international and interstate migration. The model is solved with the GEMPACK economic modelling software [Harrison and Pearson (1996)].

3.2 Model closure

In solving VURMTAX, we undertake two parallel model runs: a baseline simulation and a policy simulation. The baseline simulation is a business-as-usual forecast for 2017-40. The policy simulation is identical to the baseline simulation in all respects, other than the addition of shocks describing the tax policy under investigation. We report results as percentage (and in some cases, A$m) deviations in the values of variables in each year of the policy simulation, away from their baseline values.[14]

The policy simulations are conducted under the following model closure:

(1) Regional labour markets are characterised by short-run real wage stickiness with endogenous regional unemployment rates, transitioning to a long-run environment of regional wage flexibility with exogenous regional unemployment rates.

(2) Rates of inter-regional migration are sticky in the short-run, but adjust gradually in response to movements in inter-regional real consumer wage relativities in order to ensure that such wage relativities gradually return to baseline values.

(3) Regional participation rates adjust to deviations in region-specific real consumer wages.

(4) National private consumption spending is the sum across regions of regional private consumption.

(5) Regional average propensities to consume from income are endogenously adjusted by a uniform percentage across all regions, to ensure that the deviation in the ratio of national-net-foreign-liabilities-to-national-income is stable in the long-run.

(6) We assume a constant ratio of real consumption spending of each regional government to real private consumption spending within each region. For federal consumption spending within

[14] See Dixon and Rimmer (2002) for a thorough review of the construction of baseline and policy simulations with a detailed CGE model.

each region, we assume a constant ratio of region-specific federal public consumption spending to national private consumption.

(7) Net operating balances of regional governments and the federal government are held at baseline values via endogenous determination of lump sum payments to households [denoted $LST_{(g)}$, where $g \in$ GOV, and the set GOV spans all VURMTAX governments: NSW, RoA, Federal]. National lump sum payments [$LST_{(Federal)}$] are apportioned across regions on a per-capita basis.

3.3 Valuing leisure in VURMTAX

In VURMTAX, the value of leisure in A$m. in region q in year t of our simulation is equal to:

$$\text{VLEIS}_{q,t} = \text{RWAGE}_{q,t}^{c,B} \cdot WPOP_{q,t} \cdot \left[1 - PRT_{q,t}\right], \tag{22}$$

where superscript "B" denotes a variable that takes its baseline value in both the baseline and policy simulations, $\text{RWAGE}^{c,B}_{q,t}$ is the baseline value of the real consumer (superscript c) wage in region q at time t, $\text{WPOP}_{q,t}$ is region q's working age population at time t, and $\text{PRT}_{q,t}$ is region q's participation rate at time t. When the participation rate in region q increases in a policy simulation, i.e., $\text{PRT}_{q,t} > 0$, this materialises via an expansion in region-specific labour supply relative to the region-specific working age population. From equation (22), this reduces the value of leisure derived by households, because some leisure time has been forsaken to increase labour supply in response to the new (higher) policy simulation real post-tax consumer wage. At the national level, we compute the value of changes in leisure time by summing equation (22) over all $q \in REG$.

3.4 Calculating the excess burden of taxation

The term "excess burden" was coined by Harberger (1962) to describe the impact (in totality) of US corporate tax on US national income. Because VURMTAX is dynamic, it can calculate year-on-year excess burden measures using a similar principle. More specifically, the efficiency loss caused by a tax policy package in time-period t at the national (Australia-wide) level ($\text{EB}^{t}_{\text{Nat}}$) is evaluated according to:

$$\text{EB}^{t}_{\text{Nat}} = -100\left[\frac{\Delta GNI^{t} + \sum_{q} \Delta VLEIS^{t}_{q}}{\sum_{g} \Delta LST^{t}_{g}}\right], \tag{23}$$

where ΔGNI^{t} is the deviation in real gross national income (GNI) in year *t* expressed as the difference between the policy simulation and baseline simulation values for GNI in year *t*; $\Delta VLEIS_{q}^{t}$ is the deviation in the value of leisure in region *q* at time *t*; and ΔLST_{g}^{t} is the deviation in revenue-neutral lump sum transfer by government *g* in year *t*. Equation (23) is a measure of the change in real national income, adjusted for changes in the value of leisure, caused by a change to state or federal tax policy that results in a change in the government's capacity to make a budget-neutral transfer to Australian households of $\sum_{g} \Delta LST_{g}^{t}$. By using the value of aggregate lump sum payments to households in the denominator (rather than, say, revenue raised from the particular tax in question), we take account of general equilibrium effects, including induced changes in: revenue raised from other tax basis, the price of government spending, and government benefit payments.

In addition to the national excess burden measure, we calculate a state economic damage indicator (SEDI) via:

$$\mathrm{SEDI}_{\mathrm{NSW}}^{\mathrm{t}} = -100\left[\frac{\Delta GSP_{NSW}^{t} + \Delta VLEIS_{NSW}^{t}}{\Delta LST_{NSW}^{t}}\right]. \tag{24}$$

Equation (24) is a measure of the change in the size of the NSW economy, adjusted for changes in the value of leisure, caused by a change to NSW tax policy that results in a change in the NSW government's capacity to make a budget-neutral transfer to NSW households of ΔLST_{NSW}^{t}.

4 Simulations and results

To study the impact of council rates and state land taxes, we perform six simulations. Each simulation is undertaken under the closure described in section 3.2. Hence, results are readily comparable across the tax policy simulations. To study the relative efficiency of NSW state land tax:

(1) We raise an additional A$100m in land tax revenue in NSW in 2019 via a one-off and uniform (across all industries) percentage rise in the land tax rate. Exempt industries remain exempt. Under our assumption of budget neutrality, this simulation provides an estimate of the national *marginal* excess burden for NSW land tax, and an associated marginal SEDI for NSW.

(2) We reduce land tax rates in NSW by 95% relative to the level under the baseline forecast in 2019. Under our assumption of budget neutrality, this simulation provides an estimate of the national *average* excess burden of NSW state land tax, and an associated average SEDI for NSW.

In addition, we perform two simulations to explore the impact of the PPR exemption:

(3) We raise A$100m in NSW state land tax revenue by altering the 2019 land tax rate on dwellings, keeping all other rates unchanged. Owner-occupied dwellings remain exempt. Under our assumption of budget neutrality, this simulation yields an estimate of the *marginal* excess burden and SEDI for NSW land tax on dwellings, with the PPR exemption in place.

(4) We reduce land tax rates in 2019 on dwellings in NSW by 95% relative to their baseline level. Under our assumption of budget neutrality, this simulation yields an estimate of the *average* excess burden and SEDI of NSW state land tax on dwellings, with the PPR exemption.

Finally, as a point of comparison, to study the impact of local council rates on UIV in NSW:

(5) We raise an additional A$100m in NSW council rate revenue in 2019 via a one-off and uniform (across all industries) percentage rise in the council rate. Under our budget neutrality assumption, this simulation estimates the *marginal* excess burden and SEDI for NSW council rates.

(6) We reduce NSW local council tax rates by 95% relative to the level under the baseline forecast in 2019. Under our assumption of government budget neutrality, this simulation provides an estimate of the *average* excess burden and SEDI of local council rates in NSW.

In section 4.1, we study the excess burdens and SEDIs for NSW state land tax, NSW state land tax on dwellings and NSW local council rates. Section 4.2 focuses on macroeconomic impacts of state land tax exclusively, while we summarise the industry impacts of NSW state land tax in section 4.3.

4.1 **Excess burden analysis**

The long-run MEB, AEB and SEDI values for NSW state land tax are reported in Table 1(i). Table 1(ii) and Table 1(iii) summarise equivalent results for NSW state land tax rate on the dwellings sector, and NSW local council rates (respectively).

From Table 1(i), we see that the AEB of NSW land tax is low (equal to 1 cent per dollar of net revenue raised). The average SEDI is lower, at 0. The MEB and marginal SEDI are larger than their average counterparts, but still relatively low at 4 and 8 respectively. An interesting result is that the national average excess burden measure in Table 1(i) is higher than the corresponding regional SEDIs, despite all tax policy experiments being unilateral, i.e., we only alter land tax rates in NSW. This pattern is not evident in the MEB experiment in Table 1(i), or for any experiments in Table 1(ii), where we alter NSW land tax rates on dwellings only, but appears again for both the MEB and AEB experiments for NSW local council rates [see Table 1(iii)]. With regard to local council rates, we expect state economic damage indicators to lie below national excess burdens, because local council rates fall on an immobile factor of production: land. With the incidence of the tax falling largely on landowners, there is little distortion in economic behaviour and thus little in the way of allocative efficiency effects. In contrast, increases in many other NSW state taxes damage NSW competitiveness; this leads to resource outflow from NSW. This interstate competitiveness effect is not at work with council rates, because the immobility of land prevents the tax passing into NSW production costs. In what follows, we address why a similar pattern emerges on average for NSW state land tax, but not at the margin, i.e., the AEB > average SEDI for land tax in NSW however MEB < marginal SEDI.

As highlighted in section 2.2, an important exception to the general efficiency of NSW land tax is the PPR exemption. As described in section 2.3, to reflect the PPR exemption, we ensure that land tax payable on land allocated to each of the two dwelling types (low and high density) is paid by renters but not by owner-occupiers. This introduces an allocative efficiency distortion in dwelling tenure choice, the impact of which is highlighted in Table 1(ii). Because of the PPR exemption, NSW state land tax on dwellings finds its way into NSW relative consumption prices, i.e., the price of acquiring rented housing moves relative to the price of owner-occupied housing when the rate of state land tax on dwellings is adjusted. This is evident in Table 1(ii), where we see that the SEDI for land tax on dwellings exceeds the corresponding excess burden, both on average and at the margin. The relationship between the SEDI and the excess burden for state land tax depends on an interplay between the relative efficiency of land taxation [see our results for local council rates in Table 1(iii)], versus the inefficiency and relative price distortion generated by the PPR exemption [Table 1(ii)]. In

Table 1(i), we see that at the margin, the inefficiency generated by the PPR exemption dominates the relative efficiency of broad-based land taxation, i.e., the marginal SEDI exceeds the MEB. On average however, the two effects broadly offset one another; this drives an average SEDI and AEB that are both very close to zero.

Table 1(ii) allows us to distinguish the effects of changing land tax rates in general (Table 1(i)), from the effects of changing land tax rates on dwellings only (Table 1(ii)). The difference between the two sets of results must be the effect of changing land tax rates on the non-dwelling sectors. As expected, the marginal and average SEDIs and excess burdens in Table 1(ii) exceed the corresponding figures determined for changes in the overall rate of state land tax in NSW in Table 1(i). An interesting result is that the state average SEDI in Table 1(ii), which is equal to 18 per cent, is similar to the average excess burdens derived using the discrete choice and neoclassical models described in section 2.2, which were equal to 17.4 and 17.6 per cent respectively. This highlights the key drivers of land tax resource misallocation captured by VURMTAX.

The impact of the PPR exemption is also apparent when we study the long-run excess burden and SEDI for local council rates on UIV in Table 1(iii). Because NSW local council rates are levied on UIV and carry very few exemptions, the marginal and average excess burden and SEDIs for NSW local council rates, are lower than those for NSW land taxes (see Table 1(i) and Table 1(iii)). Indeed, the excess burden and SEDI of council rates is not only lower than that of land tax, it is negative, because without the allocative efficiency distortion caused by exemptions, a rise in local council rates yields a gain for NSW, via taxation of foreign and interstate land owners. Put another way, both land tax and council rates are paid in part by landowners who do not reside in NSW. Ceteris paribus, this drives the values of the excess burden and SEDI measures for these taxes negative. Because of the PPR exemption however, land tax creates an allocative efficiency distortion [which is large and drives large, positive SEDIs and excess burdens that we summarise in Table 1(ii)]. This distortion more than offsets the gains from taxing foreign- and interstate-owned land in NSW, resulting in the net positive SEDIs and excess burdens for state land tax reported in Table 1(i).

4.1.1 How do excess burdens and SEDIs change over time and what drives those changes?

Because VURMTAX is dynamic, it generates year-on-year MEB, AEB and marginal and average SEDI measures over the course of a tax policy experiment. In Figure 3 and Figure 4, we plot the time path of the average SEDI (Figure 3) and average excess burden (Figure 4) of: (i) NSW state land tax (solid line); (ii) NSW state land tax on dwellings (dashed line); and (iii) NSW local council rates (dotted line).

In Figure 3, the relationship between each of the three tax removal simulations becomes clear. The removal of state land tax can be thought of as a tax policy experiment in which we simultaneously: (i) reduce local council rates by an appropriate amount; and (ii) reduce the rate of state land tax on the dwellings sector only, also by an appropriate amount. In the short-run, the positive impact that reducing the rate of land tax on dwellings has on NSW housing rents is more-than-offset by foregone revenue from taxes on foreign and interstate landowners. In the long-run, the benefit we derive from removing the PPR distortion, however, offsets the impact of foregone foreign and interstate tax revenue, driving the SEDI for NSW land tax to zero.

Why do the relative impacts of these two policies shift over time? The answer is because removal of the PPR exemption reduces the price level in NSW, as the cost of rental housing in NSW falls when the PPR exemption is removed. This makes NSW real consumer wage rates (solid line in Figure 5) more competitive with real wages in other Australian states and territories (denoted RoA for Rest-of-Australia in what follows and represented by the dashed line in Figure 5), as shown in Figure 5. In the long-run, this allows NSW to expand its workforce: workers in the RoA respond to changes in relative wage rates across regions in Australia by migrating from RoA to NSW. This is illustrated in Figure 6. Gradually, a reduction in labour supply in the RoA drives real wages in the RoA higher, while damping the rise in real wage rates in NSW (see Figure 5).

The benefits of removing the PPR distortion in NSW therefore materialise in the long-run, because relative real wages rise in NSW and drive expansion in the NSW workforce, whereas the costs of reducing the land tax rate on all other industries are borne in the short-run, i.e., a windfall gain to foreign and interstate landowners materialises in the short-run when land tax rates fall. We therefore observe a relative shift in the factors driving the SEDI when land tax is removed in NSW over time: costs dominate in the short-run, and benefits are realised in the long-run. This materialises in the SEDI time plots for state land tax removal in Figure 3 (solid line), which follows the general trend of the local council rate SEDI (dotted line, Figure 3) in the short-run, before displaying a general trend that more closely resembles the SEDI of removing state land tax on dwellings in the long-run (dashed line, Figure 3). This discussion serves to illustrate the benefits of dynamic CGE analyses of tax policy reforms, versus comparative static long-run CGE analyses.

4.2 Macroeconomic impacts

In section 4.1, we established that the driver of allocative inefficiency in the NSW land tax system is the PPR exemption. This was achieved by comparing the SEDI and national excess burden of changes in the rate of NSW state land tax, with corresponding measures calculated in response to changes in NSW local council rates on UIV, and changes in the rate of NSW land tax on the dwellings sector.

In this section, we shift from a focus on excess burden measures, to focus on the macroeconomic effects of uniform percentage changes in land tax rates (Table 2). While we provide results for both a marginal (A$100m) change in land tax, and removal of land taxes (herein, we reduce the rates of land tax by 95 per cent), we focus our discussion on the effects of land tax removal. Because the simulation in which we raise land tax revenue by A$100 m. differs from the full removal simulation only in terms of direction and magnitude, our discussion of the full removal simulation is equally applicable (with appropriate allowance for sign and magnitude) to the A$100m. simulation. We present comprehensive results for the long-run, i.e., we present deviations from baseline forecast in year 2040 in response to policy shocks delivered in 2019.

The long-run state and national macroeconomic impacts of removing NSW state land tax are summarised in the second column of Table 2. From there, we see that removal of state land tax (and thus the housing tenure distortion caused by the PPR exemption) raises real GDP at market prices (+0.009 per cent, row 15) relative to real GDP at factor cost (+0.003 per cent, row 16). This allocative efficiency gain is like a productivity increase. In the long-run, assuming the national population growth rate remains unchanged from baseline, the gains from this accrue to national fixed factors: labour and land. This accounts for the increase in the national real wage (+0.012 per cent, row 26). This generates a small increase in the national workforce participation rate, and thus national employment (+0.005 per cent, row 24). Together with the allocative efficiency gain, the rise in employment promotes a small increase in the capital stock relative to baseline (+0.001 per cent, row 23). The positive deviations in both employment and capital contribute to the positive deviation in real GDP at market prices, in addition to that attributable to the removal of the tenure choice distortion.

Ceteris paribus, the increase in GDP raises national income relative to baseline (+0.004 per cent, row 22). Comparing rows 15 and 22, we see that the increase in real national income is less than the increase in real GDP. This is because the elimination of land tax involves some foregone tax revenue on foreign-owned land. Because the positive deviation in national income is less than the positive deviation in real GDP, the positive deviations in consumption (private [+0.005 per cent, row 17] and public [+0.007 per cent, row 18]) are less than the deviation in real GDP (+0.009 per cent, row 15). This causes the real balance of trade to move towards surplus (+0.003 as a per cent of GDP, row 33).

We turn now to the impacts of NSW land tax removal on the state of NSW. As discussed in section 2.3, part of the incidence of land tax on rental dwellings is passed on to tenants via higher rents. At the same time, a distortion is introduced in choice of housing tenure between rental and owner-occupancy. Removal of land tax lowers the cost of rental occupancy, and eliminates the tenancy choice distortion. Both effects lower the long-run cost to NSW households of acquiring the biggest component of their consumption bundle: dwelling services. The result is a reduction in the NSW consumer price index relative to that in other states. This causes the NSW real consumer wage to rise (+0.034 per cent, row 11), which in turn generates both an increase in labour force participation, and increased migration from the RoA into NSW. This drives a long-run rise in NSW employment (+0.021 per cent, row 4). The positive deviation in NSW employment, together with the allocative efficiency gain arising from removal of the tenure choice distortion, causes NSW gross state product (GSP) to rise relative to baseline (+0.022 per cent, row 5). However, the foregoing of some land tax revenue on foreign- and interstate-owned land results in a net reduction in NSW income available for funding private and public consumption. This accounts for the negative deviations in private and public consumption (-0.043 per cent each, see rows 6 and 7).

4.3 Industry impacts

Table 3 reports results for the output deviations of NSW industries in 2040. While VURMTAX includes 76 distinct industries, in Table 3 we map the 76 industries to a 17-industry aggregation to present a set of summary industry outputs. Once again, we focus on the impact of land tax removal and refer the reader to column 2 of Table 3**.** As discussed with reference to the national macroeconomic outcomes, the national real balance of trade moves towards surplus. This is facilitated by a depreciation in the real exchange rate. This encourages positive deviations in trade-exposed sectors in NSW, like agriculture, mining, and manufacturing (+0.09, +0.17 and +0.13 per cent, rows 1, 2, and 3, column 2, Table 3). The NSW transport, postal and warehousing sector is also assisted by real depreciation, because it provides transport and storage margin services to export industries (+0.10 per cent, row 9, column 2, Table 3). The damping of NSW private and public consumption relative to baseline (-0.043 per cent each, rows 6 and 7, column 2, Table 2) causes negative deviations in the output of NSW sectors that are heavily oriented towards supplying consumption goods. This accounts for the negative deviations in the output of many other industries, including: accommodation and food services (-0.04 per cent, row 8, column 2, Table 3); dwelling services (-0.07 per cent, row 12, column 2, Table 3); Public administration (-0.01 per cent, row 14, column 2, Table 3); health care and social assistance (-0.03 per cent, row 16, column 2, Table 3); and the aggregated other services sector (-0.03 per cent, row 17, column 2, Table 3).

5 Conclusions

The Henry Review (2009) described how a shift away from taxes like conveyance duty on property transfers, and towards taxes on landowners, could create a more resilient and equitable tax system. Assessing the economic impacts of such tax reforms requires economic models with sufficient detail to study jurisdiction-specific tax reform packages. In this paper, we have described such a model, VURMTAX, a CGE model of Australia’s states and territories with embedded taxation detail and multiple layers of government. We describe how a large-scale, multi-regional CGE model like

VURMTAX can be used to explore the efficiency of two types of regional land tax: council rates, and state land tax. An interesting question is the role played by state land tax exemptions (like the primary producer land (PPL) exemption and the principal place of residence (PPR) exemption) in opening an efficiency gap between these two landowner taxes. Because NSW levies both broad-based council rates on unimproved land value, and state land tax with exemptions, we used VURMTAX to study the relative efficiency of these two NSW land taxes.

This analysis was facilitated by running a set of policy simulations in VURMTAX: (1) we raised an identical amount (A$100m) of tax-specific revenue using each of the two taxes; and (2) we reduced the rates of each tax by 95 percent, i.e., we largely eliminate the taxes and any associated distortions. These simulations allow us to calculate national-level excess burdens and state economic damage indicators (based on income and state output deviations, respectively, caused by changes in tax policy). Our research establishes that the removal of the current NSW state land tax system, i.e., including exemptions on agriculture, education, residential care and owner-occupied dwellings, causes NSW real gross state product (adjusted for changes in leisure time) to remain broadly in line with its baseline level. This is nevertheless much higher than the impact of a removal of NSW council rates, which actually reduces leisure-value adjusted real GSP in NSW by 33 cents per dollar of foregone tax revenue. The latter result is unsurprising, because a portion of NSW local council rate revenue is raised from foreign and interstate ownership of NSW land. Removing this system of taxation provides these landowners with a windfall gain.

To explain the large difference between these two results, we perform an additional set of simulations. In these simulations, we alter the NSW land tax rate on the dwelling services sector (holding all other rates exogenous and at their baseline levels). The results illustrate how the relative difference in NSW GSP response between state land tax and local council rate removals arises because of an allocative efficiency gain. This gain materialises when we remove NSW land tax, because in so doing we also remove the housing tenure choice distortion caused by the state land tax principal place of residence exemption. Our analysis quantifies the impact of the PPR exemption on the NSW economy. Additionally, the work presented in this paper establishes that other exemptions, such as the PPL exemption, play a much smaller role in driving differences in relative efficiency between NSW state land tax, and local council rates on UIV.

These findings are important, because when considering the implementation of policy reforms like those proposed in the Henry Review (2009), state governments have the means to offset lost revenue from eliminating conveyance duties via an increase in state land taxes without significant legislative reform. Revenue replacement via a broad based land tax, e.g., one similar in scope to the current system of NSW local council rates on UIV, would require new legislation. A detailed understanding of both the source and size of allocative efficiency distortions caused by an increase in state land taxes is therefore useful in informing possible future directions for Australian federal and state tax policy.

Tables and charts

Table 1: State economic damage indicators (SEDIs) and national excess burden measures, reported for the year 2040

	Marginal Column 1	**Average** Column 2
(i) State land tax in NSW		
SEDI, NSW	8	0
Excess burden	4	1
(ii) State land tax on dwellings in NSW		
SEDI, NSW	29	18
Excess burden	11	7
(iii) Local council rates on UIV in NSW		
SEDI, NSW	-32	-34
Excess burden	-9	-11

Notes: This table reports the long-run (i.e. year 2040; 21 years after the tax shock) marginal (column 1) and average (column 2) excess burden and state economic damage indicators (SEDIs) from simulations (1) and (2) [Table 1(i)], simulations (3) and (4) [Table 1(ii)] and simulations (5) and (6) [Table 1(iii)]. Experiments (1), (3) and (5) yield marginal excess burden and marginal SEDIs; all results from these experiments are therefore reported in column 1 of Table 1(i) – (iii) respectively. Column 2 is based on the results from experiments (2), (4) and (6). For a description of our model closure, see section 3.2. For a description of the excess burden and SEDI formulae, see section 3.4.

Table 2: State and national macroeconomic impacts in 2040 in simulations (1) and (2)

		Simulation (1) **Impact of a A$100m rise in state land tax revenue in NSW** % deviation from baseline (unless otherwise indicated) 2040	**Simulation (2)** **Impact of removing the NSW state land tax** % deviation from baseline (unless otherwise indicated) 2040
	NSW state-level results		
1	Price deflator, gross state product (GSP)	0.004	-0.091
2	Capital stock (rental weights)	0.000	-0.016
3	Real investment	0.000	-0.018
4	Employment	-0.001	0.021
5	Real GSP	-0.002	0.022
6	Real private consumption	0.000	-0.043
7	Real public (state) consumption	0.000	-0.043
8	Import volumes	0.000	-0.019
9	Export volumes (international)	-0.009	0.213
10	Export volumes (interstate)	-0.002	0.052
11	Real consumer wage	-0.002	0.034
12	Real producer wage	-0.001	-0.005
13	Change in the land tax base (A$m)	-151.821	4332.180
14	Aggregate tax revenue (A$m)	157.519	-4481.180
	National (Australia-wide) results		
15	Real gross domestic product (GDP), market prices)	0.000	0.009
16	Real GDP, factor prices	0.000	0.003
17	Real private consumption	0.000	0.005
18	Real public (state and federal) consumption	0.000	0.007
19	Real investment	0.000	0.001
20	Real exports	-0.001	0.019
21	Real imports	0.000	-0.001
22	Real gross national income (GNI)	0.000	0.004
23	Capital stock (rental weights)	0.000	0.001
24	Employment	0.000	0.005
25	Capital rentals (investment-price deflated)	0.000	-0.002
26	Real consumer wage	-0.001	0.012
27	Real producer wage	-0.001	0.006
28	Terms of trade	0.000	-0.006
29	Price deflator, consumption (CPI)	0	0
30	Price deflator, GDP	-0.001	0.006
31	Change in the land tax base (all states and federal, A$m)	-154.841	4417.070
32	Aggregate tax revenue (all states and federal, A$m)	139.979	-4111.408
33	Balance of trade (change as percent of GDP)	0.000	0.003

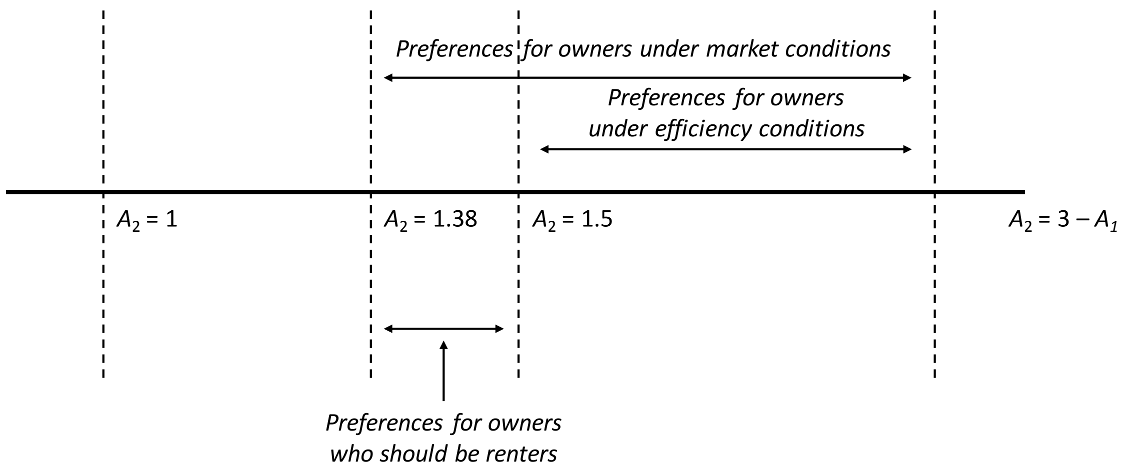
Notes: This table summarises the long-run (i.e. year 2040; 21 years after the tax shock) deviations in NSW and national (Australia-wide) macroeconomic variables from their baseline forecast. While we generally report results as percentage deviations from their baseline forecast, some variables, e.g., impacts on the tax base or aggregate government tax revenues, are best reported in millions of Australian dollars (A$m). Where units are not percentage derivations from baseline, we provide an appropriate qualification alongside the variable name. All results reported here are derived from simulations (1) and (2) (see section 4 for a description of these simulations).

Table 3: NSW industry impacts in 2040 in simulations (1) and (2)

		Simulation (1) **Impact of a A$100m rise in state land tax revenue in NSW** % deviation from baseline 2040	**Simulation (2)** **Impact of removing the NSW state land tax** % deviation from baseline 2040
1	Agriculture, forestry and fishing	0.00	0.09
2	Mining	-0.01	0.17
3	Manufacturing	-0.01	0.13
4	Electricity, gas, water and waste services	0.00	0.04
5	Construction	0.00	-0.02
6	Wholesale trade	0.00	0.02
7	Retail trade	0.00	-0.02
8	Accommodation and food services	0.00	-0.04
9	Transport, postal and warehousing	0.00	0.10
10	Information media and communications	0.00	0.03
11	Financial and insurance services	0.00	-0.01
12	Dwelling services	0.00	-0.07
13	Business services	0.00	0.02
14	Public administration and safety	0.00	-0.01
15	Education and training	0.00	-0.01
16	Health care and social assistance	0.00	-0.03
17	Other services	0.00	-0.03

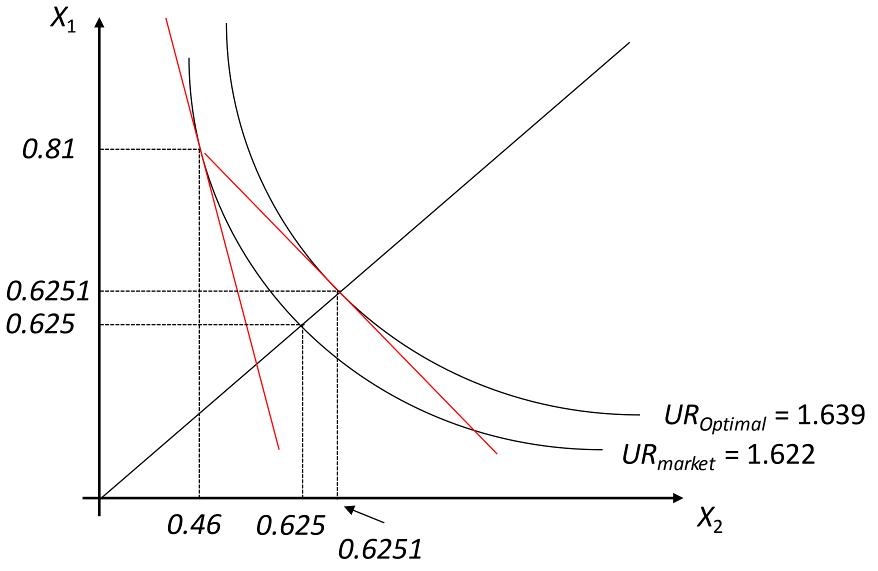
Notes: This table summarises the long-run (i.e. year 2040; 21 years after the tax rate shock) deviation in NSW real industry outputs from their baseline forecast. All results are reported as percentage deviations from the baseline forecast, and are derived from simulations (1) and (2) (see section 4 for a description of these simulations).

Figure 1: Own-versus-rent decision: Discrete choice model of housing tenure.



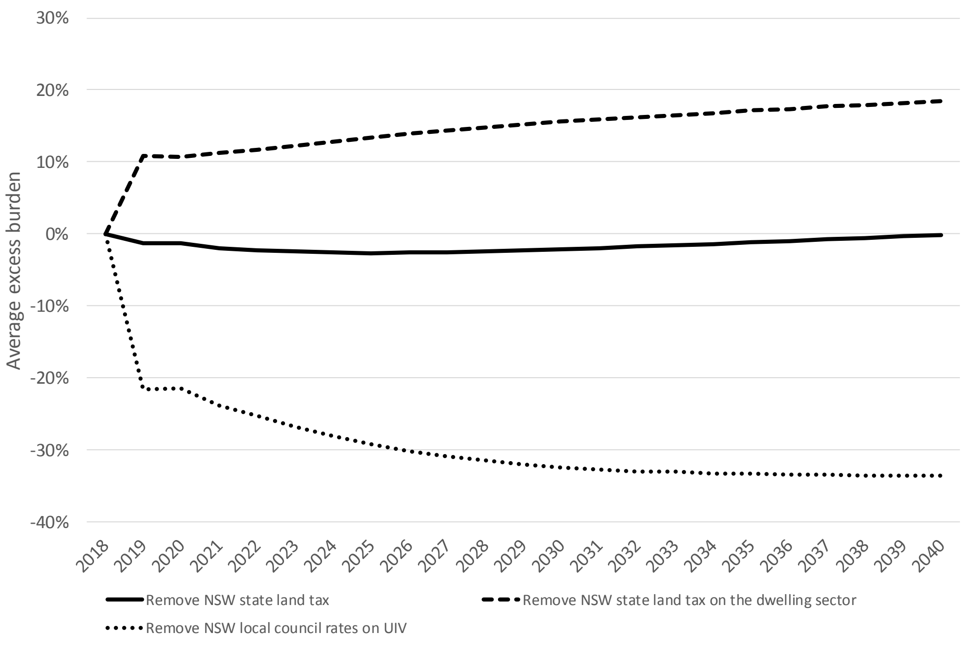
Notes: This chart provides a graphical representation of the utility maximisation problem facing household agents in the discrete choice model described in section 2.2.1.

Figure 2: Own-versus-rent decision: Representative agent model of housing tenure.



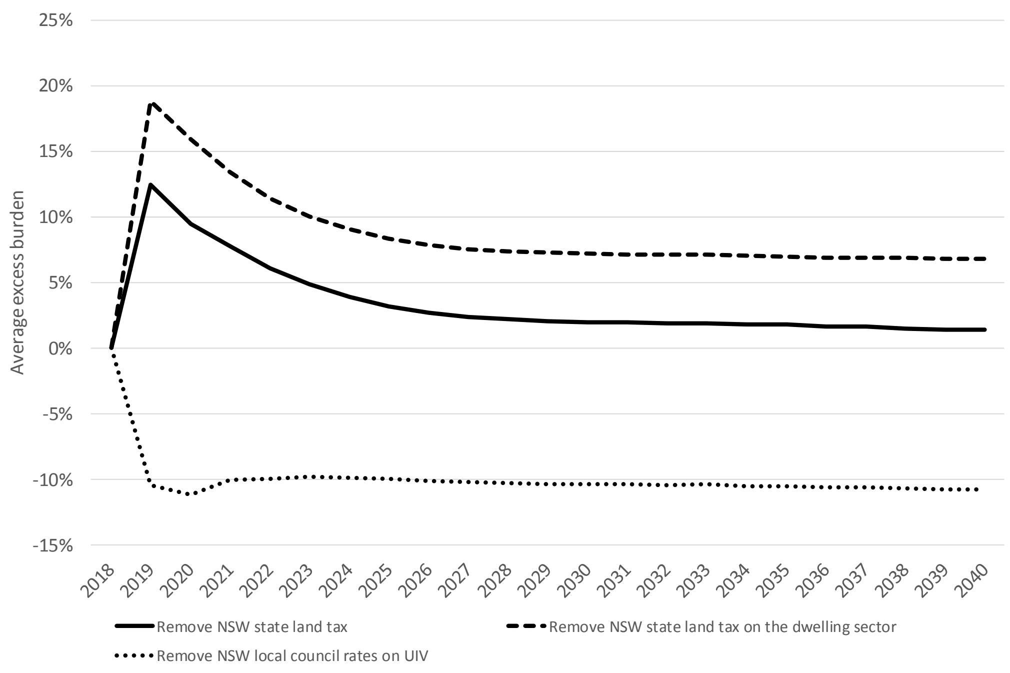
Notes: This chart provides a graphical representation of the utility maximisation problem of the representative household agent described in section 2.2.2.

Figure 3: Time paths for average state economic damage indicators (SEDIs).



Notes: This chart plots the state economic damage indicators (SEDIs) calculated from simulations (2), (4) and (6) in section 4. Because VURMTAX is dynamic, we plot the full time-paths for the SEDIs and summarise the long-run results (in the year 2040, 21 years after the tax rate shocks) for each simulation in Table 1.

Figure 4: Time paths for average excess burdens.

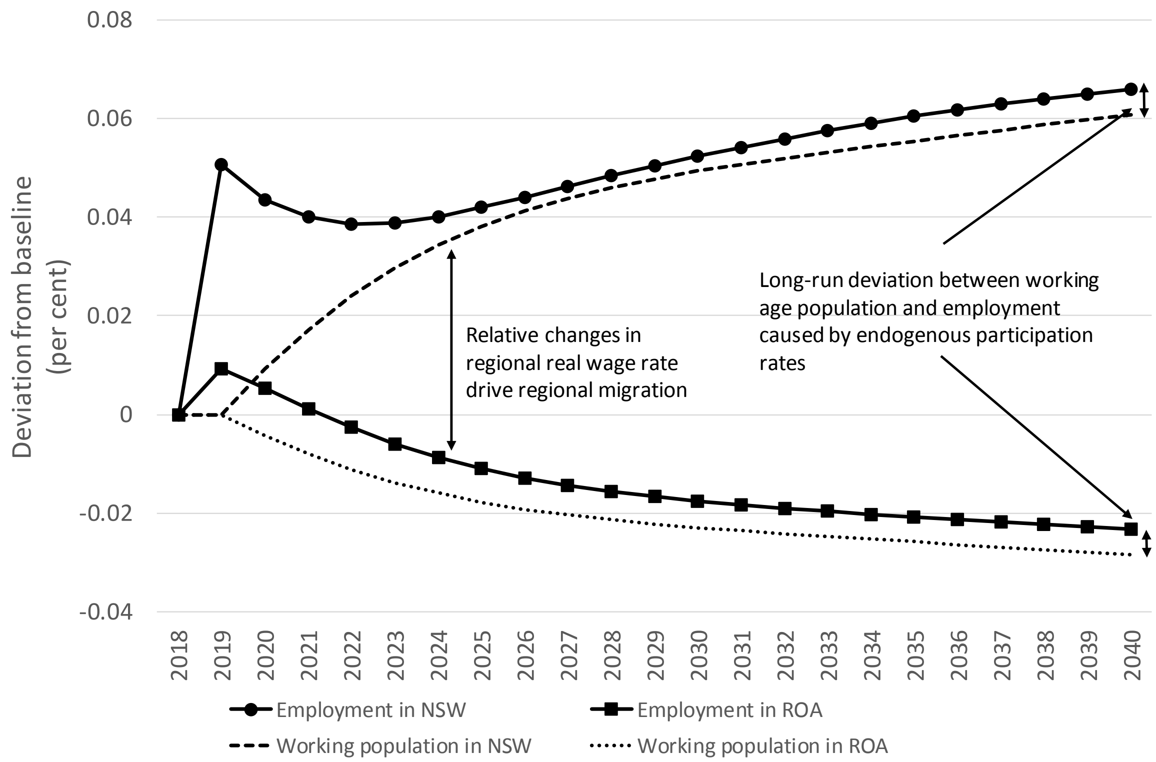


Notes: This chart plots the excess burdens calculated from simulations (2), (4) and (6) (see section 4). Because VURMTAX is dynamic, we plot the full time-paths for the excess burdens and summarise the long-run results (i.e. year 2040, 21 years after the tax rate shocks) for each simulation in Table 1.

Figure 5: Regional real consumer wage response (percentage deviation from baseline) for simulation (4): Removal of NSW state land taxes on dwellings.

Notes: This chart plots the time paths for the percentage deviation from baseline of the real consumer wage in NSW and the rest of Australia (RoA) from simulation (4) (see section 4).

Figure 6: Regional employment and working age population response (percentage deviation from baseline) for simulation (4): Removal of NSW state land taxes on dwellings.



Notes: In VURMTAX, deviations in relative regional real consumers generate equilibrating changes in interregional migration rates (see section 3.2). This chart plots time paths for the percentage deviation from baseline of the working age populations in NSW and the rest of Australia (RoA), from sim. (4) (see section 4). A policy that causes the real consumer wage in NSW to rise relative to the real consumer wage in the RoA promotes migration from RoA to NSW, as shown here. We also plot regional employment. This is not the same as regional working age population in the long-run, because the labour supply schedule in VURMTAX is upward sloping (see section 3.3).

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