

# The economic and efficiency impacts of altering elements of the ACT's tax mix

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# 1 Background

The Centre of Policy Studies (CoPS) was engaged by ACT Treasury (ACT TSY) to study the economic efficiency of the 20-year ACT Government tax reform package that began in 2012. The tax reform package is an effort to replace inefficient taxes with more efficient tax instruments, with the reforms designed to be revenue neutral.

The main elements of the tax reform package are the elimination of the stamp duty on property transfers,<sup>1</sup> the elimination of duties on general and life insurance, and their revenue being replaced by increases in the general rates applied to properties. Commercial land tax was also abolished on 1 July 2012, with the revenue replaced by an increase in general rates on commercial properties. Other features include an increase in the tax-free threshold for payroll tax and increased progressivity in the general rates system.

Stamp duty on property transfers is a feature of the tax systems of Australian states and territories. It is levied on property transactions, with the amount of the duty calculated based on the sale price. The ACT is gradually reducing the rates of stamp duty on properties over a 20-year period. The elimination of duties on general and life insurance were finalised on 1 July 2016. Increases in general rates have been calibrated to offset other changes in the tax regime.<sup>2</sup>

CoPS was commissioned to study Category 3 of the ACT TSY Request for Tender (RFT) GS001067, which posed four questions:

- 1) Are the impacts of tax reform on the ACT economy to date able to be measured?
- 2) Are the marginal impacts from each dollar of stamp duty reduction expected to increase or decrease as tax reform progresses?
- 3) Is there any evidence that ACT residential property prices are higher or lower than they would have been in the absence of tax reform?
- 4) Is residential property turnover in the ACT higher or lower than it would have been in the absence of tax reform?

This report provides a summary CoPS' modelling approach and our responses to these four questions.

As we outline in section 2, we address the questions using a mix of both Computable General Equilibrium (CGE) and econometric modelling. Our CGE study uses a two-region (ACT and the rest-of-Australia [RoA]) version of VURMTAX (see section 2.1 for a summary of the VURMTAX model) to answer questions 1 and 2, while we used econometric analysis to answer questions 3 and 4. In section 2, we describe the CGE modelling methodology in detail. Section 3 summarises our CGE modelling results and answers to questions 1 and 2. In section 4, we describe the econometric model we used to answer question 3 and 4, and summarise our findings. Concluding remarks are presented in section 5, with references and appendices provided thereafter.

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<sup>1</sup> Stamp duty on property transfers is often referred to as transfer duty or conveyancing duty. We use these terms interchangeably throughout our report.

<sup>2</sup> The ACT Government has also introduced a system of 'barrier-free conveyancing', which simplifies the process of registering a transaction and paying the duty. The new system was introduced on 18 September 2017.

## 2 CGE modelling methodology

### 2.1 CGE modelling using VURMTAX

VURMTAX is an 83-industry computable general equilibrium model of Australia based on the Victoria University Regional Model (VURM) [see Adams et al. (2015) for a description of VURM]. VURMTAX is designed for detailed taxation analysis and is described in Nassios et al. (2019a). Herein, we use a two-region (ACT and the RoA) aggregation of the core eight-region VURMTAX database. In order to parameterise VURMTAX, CoPS relies on data from a variety of sources, including the Australian Bureau of Statistics (ABS) Census data, Agricultural Census data, state accounts data, and international trade data. The core VURMTAX model database underwent a significant update during 2019 to incorporate the ABS 2015/16 Input-Output data release, together with updated Government Financial Statistics data from ABS cat. no 5512.0.

Each region in VURMTAX has a single representative household, and a single state/local government agent. 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.

Investment in each regional industry is 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. The theory underpinning these two investor classes is described in Dixon and Nassios (2018). Capital creators assemble, in a cost-minimizing manner, units of industry-specific physical capital for each regional industry.

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 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 [see Giesecke and Madden (2013) for a description of the interregional migration module in VURMTAX]. The model is solved with the GEMPACK software package [Harrison and Pearson (1996); Horridge et al. (2018)].

In solving VURMTAX, we typically undertake two parallel model runs: a baseline simulation and a policy (counterfactual) simulation. The baseline simulation is a business-as-usual (BAU) forecast for the period of interest. The counterfactual simulation is identical to the baseline simulation in all respects, other than the addition of shocks describing the policy under investigation. We report results as cumulative deviations (either percentage or absolute) away from base case in the levels of variables in each year of the policy simulation.

Applications of VURMTAX include analysis of the GST [Giesecke and Tran (2018)], company tax [Dixon and Nassios (2018)] and land tax [Nassios et al. (2019b)].

#### 2.1.1 Did tax reforms over 2012 to 2018 have a measurable economic impact?

To answer question 1 in Category 3 of the RFT document, we perform three simulations. The first starts in 2015-16 and runs backwards to 2011-12. This historical simulation [see Dixon and Rimmer (2002) for a detailed description of historical simulations using CGE models with MONASH-style dynamic mechanisms] is formed by imposing the reciprocal of observed percentage deviations for

2012 - 2016 of key macroeconomic variables for the ACT (see column [1] of Table 1 for a summary), revenue lines for the ACT (column [2] of Table 1), and other key national macroeconomic variables (see column [3] of Table 1).<sup>3</sup>

**Table 1: Historical simulation target variable summary.**

| <b>ACT Targets</b><br><i>Macro variables</i><br>Column [1] | <b>ACT Targets</b><br><i>Revenue lines</i><br>Column [2] | <b>Other Targets</b><br><i>Macro variables</i><br>Column [3] |
|--|--|--|
| Real GSP   | Residential stamp duty collections                       | Real GDP   |
| Real household consumption                                 | Non-residential stamp duty collections                   | National real household consumption                          |
| Real state government consumption                          | General rate collections                                 | The national unemployment rate                               |
| Real federal government consumption                        | State land tax collections                               | The CPI  |
| Real import volumes  | Payroll tax collections                                  | The national terms of trade                                  |
| Aggregate real investment                                  | Gambling tax collections                                 |  |
| Unemployment rate  | General insurance duty collections                       |  |
| Ownership transfer costs                                   | Life insurance duty collections                          |  |
|  | Ambulance levy collections                               |  |
|  | Lifetime Care and Support levy collections               |  |

Each of these observations is accommodated by adjusting a structural variable in VURMTAX. For example, the forecast for ACT GSP is accommodated via endogenous determination of labour-augmenting productivity growth in the ACT, thus revealing the amount of labour productivity growth that was required to achieve the real GSP result for the ACT in any given year of the historical simulation, given the imposed targets for real investment, public/private consumption, etc.

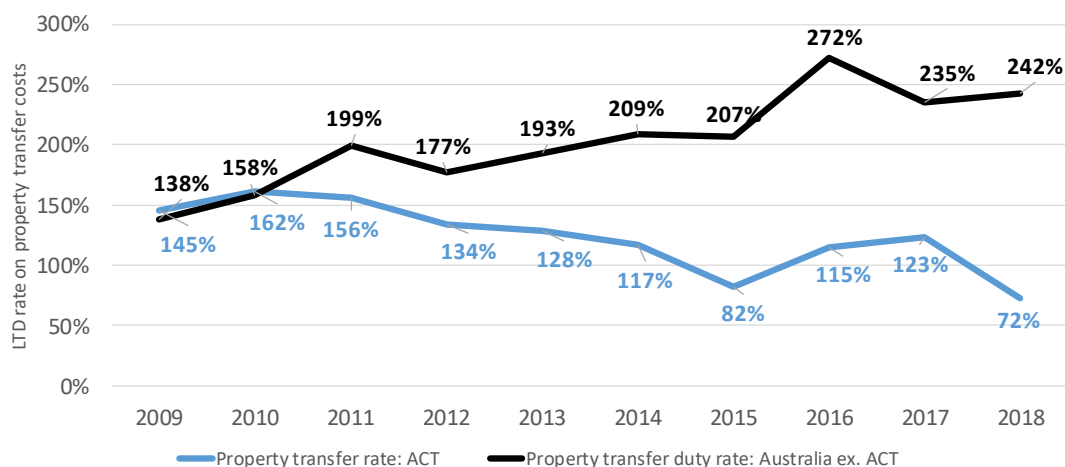
To accommodate revenues by tax line (see Column [2] of Table 1), we allow for endogenous determination of a suitable tax rate, threshold, or consumer/industry consumption preference variable. In the case of payroll taxes for example, we allow thresholds to adjust in order to ensure aggregate collection targets are achieved year-on-year. This is because the ACT-legislated payroll tax rate has remained at 6.85 per cent over the historical simulation period, however the threshold is higher in 2018 than it was in 2012.

The revenue-neutral switch from stamp duty and insurance duties to property taxes under the ACT tax reform package is also captured here, because as we summarise in column [2] of Table 1, we exogenously impose revenue targets for general rates and land tax in the ACT, in addition to property stamp and insurance duty revenues. In order to achieve the target level of residential property duty collections, VURMTAX endogenously determines the household preference for a commodity bundle called *Moving Services* (see section 3.3 for a description of this bundle). The rate of stamp duty on this bundle of goods is also exogenously imposed, in order to match ABS data on Ownership transfer

<sup>3</sup> This means, among other things, that population growth imposed in our historical simulation is negative and equal to  $100 * [1 / (1 + 0.01 * pop_t) - 1]$ , where *pop* is the observed rate of population growth that occurred in simulation year *t*.

costs<sup>4</sup> in the ACT over time (see Figure 1). A similar process is applied to model non-residential moving service demand in our historical simulation. This yields accurate baseline forecast moving preferences for households and industries, and taxation-induced relative price distortions.

**Figure 1: Specific tax rate of conveyancing duty taxes on ownership transfer costs**



Having arrived at a set of structural change estimates using VURMTAX, we then carry these forward in a second simulation, which is identical to the first however run in reverse, i.e., having arrived at 2011-12, we now return the model to forecast mode and project forward to 2017-18 by imposing the derived structural changes as shocks.<sup>5</sup> For example, if the historical simulation reveals that productivity growth would need to contribute 0.4 percentage points to GSP growth to achieve the ACT’s GSP result for 2014-15, this rate of productivity growth would be applied in our forecast simulation for the year 2014-15.

In the third simulation, we hold tax rates for life and general insurance duties and property stamp duty at their 2011-12 levels. This increases tax revenues (relative to second simulation) from these taxes, which we recycle on a dollar-for-dollar basis via a reduction in general rates collections. Comparing results of the third simulation (no tax reform) with the second (base case run in forecast rather than historical mode) show, in the context of VURMTAX, the effects over the historical period of the ACT tax reform package. This comparison is discussed in section 4.1. We report our results as deviations of the second simulation from the third simulation.

### 2.1.2 Are there increasing or decreasing marginal benefits to ongoing tax reform?

To answer question 2 in Category 3 of the RFT document, we perform three additional simulations. First, we form a BAU forecast by imposing key macroeconomic and revenue variables for the ACT and RoA on VURMTAX for 2017 and 2018 (see Table 1 for a summary of the results we exogenously impose on the model). The remainder of the baseline forecast (2019 – 2032) relies on standard CoPS assumptions for key macroeconomic variables. Specifically, we hold the national terms of trade exogenous, and assume real GDP growth of 2.8 per cent per annum. The numeraire in all simulation years is the national CPI (including owner-occupied housing).<sup>6</sup> This BAU forecast assumes no change in moving service preferences or stamp duty rates in the ACT from 2019 to 2032.

<sup>4</sup> Figure 1 plots the rate of stamp duty on ownership transfer costs in the ACT using Tables 26 - 33 in ABS cat. no. 5206.0, and tax revenue data for all state governments from ABS 5506.0

<sup>5</sup> To move from 2015-16 to 2017-18 in our baseline forecast, we impose on the model shocks for the variables listed in Table 1 sourced once again from ABS state accounts data, ABS Government Financial and Taxation statistics, and ACT TSY Revenue statements. The latter are particularly useful in determining the revenue derived from non-residential versus residential property transfer duty over the historical decomposition period.

<sup>6</sup> The CPI is assumed to grow at a rate of 2 per cent p.a. for all simulation years.

The second and third simulations are very similar. Each simulation is identical to the BAU forecast for 2017 – 2019. In 2020 however, we reduce the stamp duty rate on property transfers in each simulation and replace foregone revenue on a dollar-for-dollar basis with an increase in general rates revenue in the ACT. In the second simulation, we reduce the stamp duty rate in the ACT by a small amount (a once-off and permanent reduction of five percent in 2020 relative to its BAU forecast level). In the third simulation, we completely remove stamp duty in the ACT in 2020.<sup>7</sup> We use the results of these simulations to determine whether the marginal impact from each dollar of stamp duty reduction is expected to increase or decrease, by calculating net economic benefit indicators (N-SEBIs) for each simulation. The methodology we employ to derive the N-SEBIs is described in section 2.2, while our analysis is outlined in section 3.2.

### 2.1.3 VURMTAX closure

In solving VURMTAX, we report results as percentage (and in some cases, A\$m or head count) deviations in the values of variables in each year of the policy scenario, away from their baseline values.<sup>8</sup> All policy simulations conducted herein are undertaken under the following model closure:

- (1) Regional labour markets characterised by short-run real consumer wage stickiness with endogenous regional unemployment rates, transitioning to a long-run environment of regional wage flexibility with exogenous regional unemployment rates<sup>9</sup>;
- (2) Inter-regional migration patterns are modelled as per Giesecke and Madden (2013). Rates of inter-regional migration are therefore sticky in the short-run, but adjust gradually in response to movements in inter-regional relativities in real consumer wages in order to ensure that such income relativities are gradually returned to baseline values;
- (3) Regional participation rates adjust to deviations in region-specific real consumer wages, as described in Nassios et al. (2019a,b);
- (4) National private consumption spending is the sum across regions of regional private consumption. Within each region, private consumption spending is a given proportion of regional disposable income;
- (5) We assume public consumption spending undertaken by state and local government, and by the federal government, is tied to regional population relativities;
- (6) In line with previous CGE analyses of tax policy changes using VURMTAX, e.g., see Dixon and Nassios (2018) and Nassios et al. (2019a,b), net operating balances of (i) the RoA public sector relative to GSP; and, (ii) the federal government relative to GDP, are each held at their baseline forecast levels via endogenous determination of non-distorting lump sum taxes on households;
- (7) For the ACT, foregone (additional) property stamp duty revenue, and general and life insurance duty revenue, is recycled by increasing (reducing) tax revenue derived from general rates in the ACT;

## 2.2 Calculating net state economic benefit indicators in VURMTAX

In this section, we describe the methodology used to derive net state economic benefit indicators (N-SEBIs) using VURMTAX. The methodology is similar to that which underpins the VURMTAX excess burden module; see Nassios et al. (2019a, b) for a description.

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<sup>7</sup> Once again, revenue is replaced dollar-for-dollar with an increase in general rates in the ACT.

<sup>8</sup> See Dixon and Rimmer (2002) for a thorough review of the construction of baseline and policy simulations with a detailed CGE model.

<sup>9</sup> The real consumer wage is defined as the nominal wage, deflated by a division consumer price index that excludes owner-occupied housing expenditures.



For any given revenue-neutral tax mix change, the gain in economic output experienced in time-period  $t$  in the ACT, per dollar of revenue swapped, or the net state economic benefit ( $N-SEBI_{ACT}^t$ ) of a given tax neutral swap, is evaluated according to the equation:

$$N-SEBI_{ACT}^t = 100 \left[ \frac{\Delta GSP_{ACT}^t + \Delta VLEIS_{ACT}^t}{\Delta SR_{ACT}^t} \right], \quad (1)$$

where:

- $\Delta GSP_{ACT}^t$  is the deviation between the year  $t$  counterfactual and baseline value of real gross state product (deflated in the usual way by the GSP deflator and measured in A\$m) in the ACT;
- $\Delta VLEIS_{ACT}^t$  is the deviation in the value of leisure time consumed by ACT residents in year  $t$ , valued at the BAU forecast real consumer wage rate [see Nassios et al. (2019a, b) for a description];
- $\Delta SR_{ACT}^t$  is the value of swapped tax revenue.

To study whether the marginal impact on economic output of tax reform is a decreasing function of revenue swapped, we calculate  $N-SEBI_{ACT}^t$  for the policy scenarios described in section 2.1.2. This yields two economic benefit indicators:  $N-SEBI_{ACT,5pc}^t$  and  $N-SEBI_{ACT,100pc}^t$ . To assess whether there are increasing or decreasing benefits to reform, we compare these two economic benefit indicators. Decreasing benefits to reform would imply that the N-SEBIs satisfy the following inequality:

$$N-SEBI_{ACT,5pc}^t > N-SEBI_{ACT,100pc}^t. \quad (2)$$

The inequality in (2) states that the economic output gain per dollar of revenue swapped is larger when we swap a small amount of stamp duty revenue for broad-based land tax revenue, than when we swap all stamp duty for broad-based land tax revenue. Alternatively, if there are increasing marginal benefits to stamp duty reductions, we expect the direction of inequality (2) to be reversed, i.e.,

$$N-SEBI_{ACT,5pc}^t < N-SEBI_{ACT,100pc}^t. \quad (3)$$

To assess *a priori* whether we expect increasing or decreasing benefits to reform, we run four additional simulations using VURMTAX. In the first two simulations, we reduce property transfer duty revenues by:

- (i) 5 per cent below their 2020 baseline forecast levels via a once-off and permanent reduction in the transfer duty rate in the ACT; and
- (ii) completely remove property transfer duty in 2020. In each case, the revenue is replaced using a non-distorting lump sum tax on ACT household income.

We use equation (1) to calculate  $N-SEBI_{ACT}^{2032}$  for each simulation, i.e., we report the N-SEBI for a small reduction in property transfer duties, and complete removal of property transfer duties. Our results are reported in rows (i) and (ii) of Table 2. In the next set of simulations, we:

- (iii) simulate a small rise in ACT general rates that would be sufficient to offset the property transfer duty revenue lost in simulation (i); and
- (iv) increase general rates in 2020 by enough to completely replace property transfer duty revenues.

In each of (i) – (iv), we return the revenue to ACT households as lump sum transfers. The associated N-SEBIs for these two simulations are reported in rows (iii) and (iv) of Table 2.

**Table 2: Net state economic benefit indicators for the ACT in 2032**

| <b>Property transfer duty<sup>10</sup></b> |     |
|--|-----|
| (i) Small reduction                        | 105 |
| (ii) Complete removal                      | 83  |
| <b>General rates</b>                       |     |
| (iii) Offset forgone revenue in (i)        | 10  |
| (iv) Offset foregone revenue in (ii)       | 21  |

From row (i) in Table 2, we see that small reductions in property transfer duties increase ACT real GSP by 105 cents per dollar of transfer duty revenue swapped. Comparing this to row (ii), we see that small reductions in property transfer duties yield a larger increase in real GSP in the ACT, per dollar of revenue swapped, than complete removal of the tax (which also increases real GSP in the ACT relative to the revenue swapped, but by a smaller amount of 83 cents per dollar of transfer duty revenue swapped). The results in rows (i) and (ii) of Table 2 therefore satisfy inequality (2), i.e., there are *decreasing* marginal benefits to transfer duty rate reduction. This is in line with findings by Harberger (1962; 1964; 1966), who established that the size of the economic distortion of taxation scales with the square of the level of the tax rate.<sup>11</sup>

Comparing rows (iii) and (iv) in Table 2, we find that the N-SEBI of increasing ACT general rates is also positive, i.e., increasing general rates in the ACT and returning the revenue to ACT households increases real GSP in the ACT. This finding is in line with those by Nassios et al. (2019b), who studied the system of state land tax and local council rates in NSW using VURMTAX. Interstate/territory competitiveness effects are not at work with broad-based land taxes like the ACT general rates system, because the immobility of land prevents the tax passing into regional production costs [Nassios et al. (2019b)].

In contrast to the results for property transfer duty, rows (iii) and (iv) in Table 2 satisfy inequality (3). This establishes that (a) there are marginal benefits to increases in landowner taxation, which arises due to taxation of interstate and foreign landowners; and (b) the marginal benefits increase as the rate of the tax increases.

There are thus two forces driving whether the marginal impacts of ongoing transfer duty/general rates swaps are expected to increase or decrease as ACT tax reforms continue. Firstly, the marginal benefit of *reducing* transfer duty rates fall as the transfer duty rate falls. As discussed, this is clear when we

<sup>10</sup> In simulations (i) and (ii), we have reduced the rate of property transfer duties, and replaced lost revenue with lump-sum taxes on ACT households. Because these lump-sum taxes do not distort relative prices in the ACT (in this case, the price of consuming moving services and thus the decision of whether to move house or not), a large positive state economic benefit materialises.

<sup>11</sup> If  $T$  is the rate of a given tax, then the economic damage caused by the tax is proportional to  $T^2$ .

compare rows (i) and (ii) in Table 2. Second, there are *increasing* marginal benefits to broad-based landowner taxation, which are evident in rows (iii) and (iv) in Table 2.

We can use Table 2 to estimate the economic benefit of reducing property transfer duty revenues by 5 percent and replacing the revenue with an increase in general rates, by adding the results in rows (i) and (iii) together. Doing the same for rows (ii) and (iv) yield an estimate of the economic benefit of a revenue-neutral replacement of transfer duty with general rates in the ACT. The results are summarised in Table 3: in row (i) we provide an estimate of  $N-SEBI_{ACT,5pc}^t$  that appears in inequalities (2) and (3), while the result in row (ii) of Table 3 is an estimate of  $N-SEBI_{ACT,100pc}^t$ .

**Table 3: Estimated net state economic benefit indicators (N-SEBIs) for the ACT in 2032, replacement of property transfer duties with general rates revenue**

|      |   |     |
|------|---|-----|
|      | Estimate of                             |     |
| (i)  | $N-SEBI_{ACT,5pc}^t$ using<br>Table 2   | 115 |
|      | Estimate of                             |     |
| (ii) | $N-SEBI_{ACT,100pc}^t$<br>using Table 2 | 104 |

Our estimated N-SEBIs in Table 3 are similar in magnitude and satisfy inequality (2), i.e., there are *decreasing* marginal benefits to economic output when replacing property transfer duties with general rates in the ACT because row (i) > row (ii) in Table 3. As we show in section 3.2, this conclusion is consistent with our analysis of the policy scenarios described in section 2.1.2.

### 2.3 Modelling insurance taxes in VURMTAX

VURMTAX distinguishes five distinct insurance taxes:

- General insurance duties;
- Life insurance levies;
- Health insurance levies;
- Compulsory Third Party (CTP) duties, levies and charges; and,
- Fire and Emergency Service levies (FESL).<sup>12</sup>

Significant effort is made to ensure tax rates on resource usage are properly calibrated to reflect APRA Quarterly Performance Statistics for General, Life and Health Insurers across Australia’s states and territories. For a full discussion of this procedure, we refer the reader to Nassios et al. (2019a), which fully documents how these data are reflected in VURMTAX.

To model the ACT tax system, we treat general insurance duties as taxes on the consumption of general insurance by industries and households in the ACT. In VURMTAX, General insurance duties are GST exempt, which distinguish them from FESLs such as those in NSW, which attract GST.

Life insurance duties are modelled in a similar way to General insurance duties. No tax load falls on industries, however, because life insurance is entirely consumed by ACT households.

<sup>12</sup> Because VURMTAX is a multi-regional model of Australia’s states and territories, the model code is general to accommodate data from states, e.g., NSW, where fire and emergency service financing continues to rely on levies on insurance premiums.

Other levies classified by the ABS as insurance taxes, such as the ACT Ambulance levy and the Lifetime Care and Support Levy, are also explicitly modelled in VURMTAX. The Ambulance levy is modelled as an ad valorem health insurance duty, while the Lifetime Care and Support levy is modelled in a similar way to motor vehicle registration charges in VURMTAX, because it is payable at the time that a motor vehicle is registered in the ACT.

With this framework in place, VURMTAX is equipped with the detail required to model the economic impacts of compositional changes in ACT state tax revenues on economic welfare.

## 2.4 Modelling property transfer duties in VURMTAX

Stamp duty on property conveyancing applies to the transfer of ownership of most properties, with the duty base being the value of the property purchased. In all Australian states, a progressive rate schedule is employed. While the tax base for conveyancing duty is the value of the property, the activity being taxed is the process of property transfer. The value of the resources used in transferring property ownership is usually only a fraction of the property price. This is highlighted in Figure 1, which plots ABS data on ownership transfer costs relative to property transfer duty collections in the ACT and the rest of Australia from 2008-09 through to 2017-18. The sharp rise in conveyancing duty rates in the RoA relative to the ACT depicted in Figure 1 are reflective of the sharp rise in property prices in NSW and Victoria in particular, relative to the price of the goods households and industries consume to transfer their properties, and the ACT tax reform package that has lowered ACT transfer duty costs for ACT households and businesses since 2012.

VURMTAX models conveyancing duty as a tax on (i) ownership transfer costs by industries and households; and (ii) a tax on new investment in residential or non-residential capital. The share of aggregate stamp duty revenue in ACT that is derived from residential versus non-residential property transfers is based on data from the ACT TSY for 2015/16 transfer duty collections, which yields a 66/34 split between residential and non-residential property duties. We further apportion the 66 per cent of total transfer duty revenue that falls on residential property into (i) a share that falls on new property, amounting to 15.3 per cent of total revenue; and (ii) a share collected from existing property transfers, which amounts to 50.7 per cent of total property transfer duty collected in the ACT.<sup>13</sup> The share falling on existing property transfers are modelled as per Nassios et al. (2019b), i.e., as a tax on the consumption of moving service demand by households. We model the share incident on the purchase of new properties as a tax on the production of new dwellings in the ACT. The tax load incident on low- and high-density dwellings is based on low-versus-high density dwelling investment shares for the ACT, which are sourced from the core VURMTAX database.

In order to model moving service demand in VURMTAX, four new commodities are introduced. These commodities reflect the real estate, legal (conveyancing), public administration and property inspection/engineering services households and industries purchase in order to facilitate the transfer of residential or commercial property. To model ACT residential conveyancing duty collections from *existing* property transfers, we modify the linear expenditure system governing the ACT households' consumption decisions in VURMTAX by introducing a new aggregate commodity called *Moving services*. *Moving services* is a Leontief aggregate of the four aforementioned commodities, and sales taxes on this bundle of goods are collected and linked to property transfer duty revenue from existing residential property sales. As discussed, new residential property transfer duties are modelled as production taxes on dwelling investment.

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<sup>13</sup> To arrive at this split of tax revenue from new versus existing residential property for all Australian states and territories, we rely on data for NSW residential completion volumes, and records of an aggregate NSW transfer duty collections over a 10-year time horizon. Some allowance is made for lower duty collections in NSW from new property purchases.

Industry demands for *Moving services* are assumed to be proportional to industry output levels. In VURMTAX, changes in conveyancing duty on non-residential property thus enter into industry production costs, which then has general equilibrium consequences for regional employment, investment, GSP and so forth. To split aggregate non-residential transfer duties (which are equal to 34 per cent of total collections in the ACT in 2015/16) into collections from existing and new commercial property transactions, we rely on an extensive time series of NSW bulk property sales information by property type, i.e., residential/commercial, from the NSW Valuer General.<sup>14</sup> We use this data to evaluate the average turnover rate for residential and commercial property in NSW in 2016. Our analysis shows that the average turnover rate for commercial property in NSW in 2016 was 4.7 per cent, whereas for residential property it was 5.2 per cent.<sup>15</sup> We scale the share of residential stamp duty that is collected from new housing investment (23.17 per cent of total residential transfer duty revenue) using the difference in assumed turnover rates, in order to approximate the share of commercial transfer duty earned from sales of new commercial property. This process leads us to conclude that 24.53 per cent of total non-residential property transfer duties in the ACT are derived from purchases of new non-residential properties. This proportion of total non-residential property duties in the ACT are modelled as production taxes on new non-residential capital investment.

### 3 CGE results

#### 3.1 The economic impact of the ACT Tax Reform Package: 2012 to 2018

From Figure 1, we see that stamp duty rates on Moving Service/Ownership transfer costs in the ACT were very high in 2012 compared to their level in 2018. Over the historical simulation period of 2012-2018, they have however fallen, partly due to the ACT tax reform package. *Ceteris paribus*, a counterfactual simulation of 2012-2018 where conveyancing duty tax rates (as well as general and life insurance duty rates) were held at their 2012 level would be expected to generate allocative inefficiencies, which drive down economic output in the ACT.

To assess the economic impact of reforms to date, we therefore follow the approach described in section 2.1.1. Summary results over the simulation period are provided in Table 4. In preparing Table 4, we consider two possible scenarios: (1) A world where the ACT tax reform package was not implemented, and general rates collections are lower while property stamp duty, general insurance duty and life insurance duty collections are higher; and (2) A counterfactual scenario where the ACT tax reform package was implemented. We then measure the cumulative deviation of the counterfactual scenario (2) relative to scenario (1), where we hold General and Life insurance duty rates in the ACT, and the residential and non-residential property transfer duty rates in the ACT, at their 2011-12 levels. In scenario (1), we also reduce ACT general rates revenue to offset (dollar-for-dollar) the change in ACT revenue caused by the (higher) stamp duty and insurance tax rates.

Table 4(a) summarises ACT results, while Table 4(b) provides summary national results. Because the ACT is small relative to the RoA, the impact of the reform package implemented over 2012-2018 does not drive material deviations in national macroeconomic indicators from the no-reform scenario over this time horizon.

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<sup>14</sup> The unprocessed NSW property sales information data from 1990 is freely available at <https://valuation.property.nsw.gov.au/embed/propertySalesInformation>

<sup>15</sup> We ignore strata property sales from these statistics because, though we have data on the numbers of properties by region in NSW, we do not have reliable information about the number of strata units on each strata-titled lot. Thus we can calculate the rate of turnover of non-strata properties by dividing sales by the total number of properties, but do not have a reliable denominator for an equivalent calculation for strata lots.

**Table 4: The ACT tax reform package economic impact, 2012 to 2018**

| <b>(a) ACT results</b>   |       |       |       |       |       |       |
|--|-------|-------|-------|-------|-------|-------|
|  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  |
| <i>Deviation from baseline forecast, ACT (A\$m)</i>                            |       |       |       |       |       |       |
| Real GSP (ACT)   | 5     | 15    | 28    | 54    | 88    | 112   |
| Real household consumption (ACT)   | 1     | 3     | 6     | 13    | 23    | 32    |
| Real state gov. consumption (ACT)  | 0     | 0     | 1     | 2     | 5     | 8     |
| Real federal gov. consumption (ACT)  | 0     | 3     | 9     | 20    | 41    | 68    |
| Real investment (ACT)  | 2     | 5     | 7     | 9     | 15    | 14    |
| Real international export volumes (ACT)  | 3     | 8     | 15    | 29    | 43    | 48    |
| Real international import volumes (ACT)  | 0     | 0     | 1     | 3     | 8     | 12    |
| Real interstate export volumes (ACT)   | 1     | 2     | 3     | 6     | 9     | 10    |
| Real interstate import volumes (ACT)   | 1     | 5     | 12    | 24    | 40    | 56    |
| <i>Deviation from baseline forecast, ACT (in persons)</i>                      |       |       |       |       |       |       |
| Employment (ACT)   | 22    | 66    | 131   | 265   | 410   | 527   |
| <i>Deviation from baseline forecast: ACT macro variables (in percent)</i>      |       |       |       |       |       |       |
| Real GSP (ACT)   | 0.01  | 0.04  | 0.06  | 0.12  | 0.19  | 0.23  |
| Real household consumption (ACT)   | 0.00  | 0.02  | 0.03  | 0.07  | 0.13  | 0.17  |
| Real state gov. consumption (ACT)  | 0.00  | 0.01  | 0.03  | 0.06  | 0.13  | 0.21  |
| Federal gov. consumption (ACT)   | 0.00  | 0.01  | 0.03  | 0.06  | 0.13  | 0.21  |
| Real investment (ACT)  | 0.03  | 0.07  | 0.09  | 0.12  | 0.19  | 0.16  |
| <i>Real dwelling investment (ACT)</i>  | 0.03  | 0.08  | 0.12  | 0.22  | 0.32  | 0.31  |
| <i>Real non-dwelling investment (ACT)</i>                                      | 0.03  | 0.07  | 0.11  | 0.13  | 0.17  | 0.15  |
| Real international export volumes (ACT)  | 0.22  | 0.48  | 0.71  | 1.05  | 1.24  | 1.18  |
| Real international import volumes (ACT)  | 0.00  | 0.00  | 0.01  | 0.04  | 0.09  | 0.13  |
| Real interstate export volumes (ACT)   | 0.01  | 0.01  | 0.02  | 0.04  | 0.05  | 0.06  |
| Real interstate import volumes (ACT)   | 0.00  | 0.02  | 0.04  | 0.09  | 0.15  | 0.21  |
| Rental-weighted capital stock (ACT)  | 0.00  | 0.00  | 0.01  | 0.02  | 0.02  | 0.03  |
| Employment (ACT)   | 0.01  | 0.03  | 0.06  | 0.13  | 0.20  | 0.25  |
| Working population (ACT)   | 0.00  | 0.01  | 0.03  | 0.06  | 0.13  | 0.21  |
| Workforce participation rate (ACT)   | 0.00  | 0.00  | 0.00  | 0.01  | 0.01  | 0.01  |
| Real wage (CPI ex. O-O housing deflated, ACT)                                  | 0.01  | 0.02  | 0.03  | 0.06  | 0.09  | 0.10  |
| Terms of trade (ACT)   | -0.07 | -0.15 | -0.22 | -0.32 | -0.36 | -0.34 |
| Domestic expenditure (C+I+G) (ACT)   | 0.00  | 0.02  | 0.04  | 0.07  | 0.13  | 0.19  |
| <i>Deviation from baseline level, ACT (in percent)</i>                         |       |       |       |       |       |       |
| Unemployment rate (ACT)  | -0.01 | -0.02 | -0.03 | -0.05 | -0.06 | -0.02 |
| <b>(b) National results</b>  |       |       |       |       |       |       |
|  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  |
| <i>Deviation from baseline forecast, national macro variables (in percent)</i> |       |       |       |       |       |       |
| Real GDP   | 0.00  | 0.00  | 0.00  | 0.00  | 0.01  | 0.01  |
| Real investment  | 0.00  | 0.00  | 0.01  | 0.01  | 0.01  | 0.00  |
| Real household consumption   | 0.00  | 0.00  | 0.01  | 0.01  | 0.01  | 0.01  |
| Real international export volumes  | 0.00  | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| Real state government consumption  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Real federal government consumption  | 0.00  | 0.00  | 0.01  | 0.02  | 0.03  | 0.05  |

(a) ACT results

|                                   | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-----------------------------------|------|------|------|------|------|------|
| Real international import volumes | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 |
| Rental-weighted capital stock     | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Employment                        | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Real exchange rate                | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| National terms of trade           | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

The summary table includes many results, which are reported as percentage (and in some cases, A\$m and head count) deviations in the values of variables in each year of the ACT Tax reform scenario, away from their non-reform scenario values. Here, we draw out some key points. Controlling for structural changes the ACT and national economy experienced between 2012 and 2018, we find that:

- In the short-run, the efficiency gains associated with the removal of the economic distortions caused by property and insurance duties are borne by ACT fixed factors of production, namely labour (because inter-regional migration patterns are slow to adjust) and land. In 2018, this means that real consumer wages in the ACT were 0.1 per cent higher than they otherwise would have been (in the absence of reform and holding all else equal);
- In VURMTAX, household migration decisions are driven by real wage relativities across regions in Australia. With higher ACT real consumer wages in 2018, inter-regional migration shifts towards the ACT and away from the RoA. By 2018, the ACT working population is therefore larger than it would have been in the absence of reform and holding all else equal. The workforce participation rate is also slightly higher than it otherwise would have been in 2018, because higher real consumer wages drive an increase in labour supply;
- A larger population and lower unemployment rate mean higher levels of employment, which was 0.25 per cent higher in 2018 than it would have been in the absence of reform and holding all else equal;
- Stamp duty removals affect investment via two channels.
  - The first indirect channel materialises via changes in employment. Because the commodity bundle *Moving services* is labour-intensive to produce, stamp duty removal decreases the consumer price of this bundle and stimulates *Moving service* demand, which has a direct effect on state employment. With employment levels elevated, the marginal product of capital rises.<sup>16</sup> This in turn stimulates investment.
  - The second direct channel arises because part of the tax is collected on new housing purchases. Part of the stamp duty load therefore falls directly as a tax on investment in new capital. Property stamp duty therefore elevates capital replacement costs. As this distortion is removed, the rate of return on new housing investment (measured as the rental rate relative to the replacement cost) rises, which stimulates ACT investment;
- With employment and capital stocks elevated in response to the ACT tax reform package, real GSP in the ACT is also 0.23 per cent higher in 2018 than it would have been in the absence of reform and holding all else equal;

<sup>16</sup> In VURMTAX, we assume a constant-returns-to-scale (CRS) production function. The marginal product of capital is therefore homogeneous of degree zero, and can be expressed as an increasing function of the labour-to-capital ratio. In the very short-run, i.e., the initial year of the reform (2013), capital stocks can be thought of as exogenous, largely predetermined from investment that occurred in 2012, existing capital stocks and depreciation rates. The ratio of labour-to-capital is therefore determined in the very short-run by the result for regional employment. With employment elevated by tax reform, the labour-to-capital ratio therefore rises in the very short-run and drives up the marginal product of capital.

- The lower tax rates drive regional production prices down. The ACT economy is therefore more competitive, both internationally and domestically. This accounts for the positive deviations in real international and interstate export volumes, and the negative deviation in the regional terms of trade in Table 4(a). Import-competing industries in the ACT have therefore benefited from the ACT tax reform package over 2012-2018.

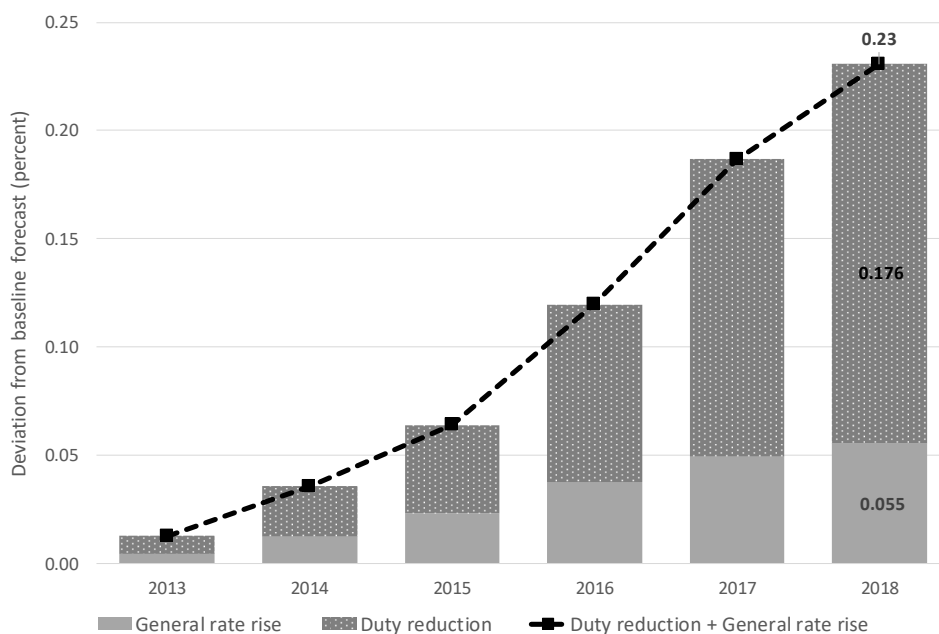
### 3.1.1 Decomposing the impact of duty removal and increasing general rates

In this section, we perform two additional simulations to study the relative impact on real GSP in ACT over 2012 – 2018 of (i) the increase in general rates revenue; (ii) the removal of life and general insurance duty, and the reduction in property stamp duties. We essentially run simulation (2) from section 3.1 in two parts: (1) we impose the general rates rise; and (2) we remove property and insurance duties. Our results for real GSP are reported in Figure 2. The results in Figure 2 can be read in the following way:

- The dotted line is the time-path for real GSP in the ACT from Table 4(a);
- The solid-fill rectangles represent the contribution to the aggregate result (dotted line) of higher general rates in the ACT; and
- The pattern-filled rectangles represent the relative impact on the aggregate result (dotted line) of removing property and insurance duties on real GSP over 2012 – 2018.

As highlighted in Figure 2, approximately 75 per cent of the economic benefit of the ACT tax reform package is a consequence of property and insurance duty removal. Foreign and interstate landowner taxation also yields an economic benefit from the rise in general rates. For a more detailed discussion of landowner taxation in Australia, we refer the reader to Nassios et al. (2019b).

**Figure 2: Decomposing the relative impact of higher general rates and lower property and insurance duties on ACT real GSP over 2012 - 2018**



### 3.2 The marginal benefit of further reform

As discussed in section 2.1.2 and 2.2, to assess the relative economic benefit of ongoing tax reforms in the ACT, we run three simulations using VURMTAX. The first is a BAU forecast, where we keep stamp duty tax rates at their 2018 levels (see section 2.1.2 for a description). In the two counterfactual runs, we simulate: (i) a once-off and permanent 5 per cent reduction in the rate of property stamp duty



in the ACT in 2020; and (ii) complete removal of the tax in 2020. In each case, foregone revenue is replaced dollar-for-dollar with an increase in general rates revenue over the simulated time-horizon.

From experiments (i) and (ii) described above, we calculate the net state economic benefit indicators  $N-SEBI_{ACT,5pc}^t$  and  $N-SEBI_{ACT,100pc}^t$  (respectively) that were defined in section 2.2 and appear in inequalities (2) and (3). As summarised in equation (1) herein, each N-SEBI is calculated by taking the ratio of the deviation (in \$m) of real GSP in the ACT (adjusted for changes in leisure time values) from its baseline forecast value, to the amount of tax revenue swapped in each experiment. If the N-SEBI figure is positive, then the tax reform simulated increases economic output in the ACT. The time paths for  $N-SEBI_{ACT,5pc}^t$  and  $N-SEBI_{ACT,100pc}^t$  are shown in Figure 3.<sup>17</sup> We can draw two main conclusions from Figure 3:

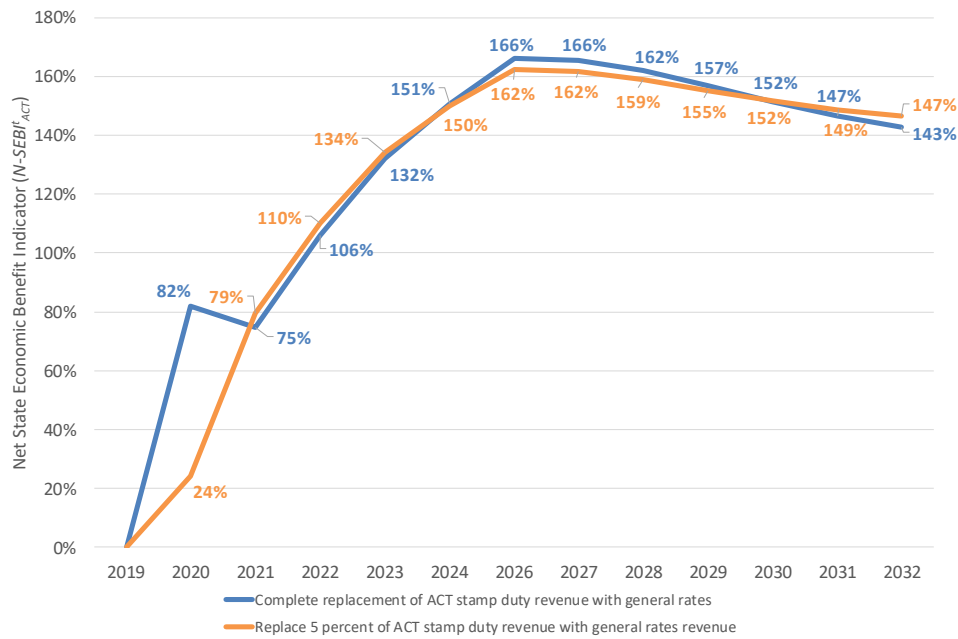
1. Both a once-off and permanent 5 per cent reduction of the stamp duty rate from its 2020 level (see the orange line in Figure 3) and complete removal of the tax (blue line in Figure 3), with dollar-for-dollar replacement of the revenue via an increase in general rates in each case, increase real economic output in the ACT across all simulated time periods. This is because the associated N-SEBIs are positive for all simulated years;
2. By 2032, inequality (3) in section 2.2 is satisfied, i.e.,  $N-SEBI_{ACT,100pc}^t$  (blue line in Figure 3) lies below  $N-SEBI_{ACT,5pc}^t$  (orange line in Figure 3).

Point 1 above establishes that ongoing reform, either via small or large reductions in property transfer duty rates in exchange for greater reliance on landowner taxation, will bring benefits via increased economic output in the ACT. Point 2 above answers question 2 in Category 3 of the RFT, and is in line with the findings of our analysis in section 2.2. As is clear from Figure 3,  $N-SEBI_{ACT,5pc}^t$  and  $N-SEBI_{ACT,100pc}^t$  are however very close to one another throughout the simulated time period. This indicates that as the tax reform package progresses over the next decade, the decreasing marginal benefit to reductions in property transfer duty rates in the ACT are largely expected to be offset by the increasing marginal benefits of broad-based landowner taxation.

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<sup>17</sup> Figure 3 is a measure of the *relative gain* of swapping property transfer duties with an increase in general rates revenues. In absolute terms, completely replacing property transfer duty with general rates revenue in the ACT in 2020 drives real GSP in the ACT above baseline forecast by 0.612 per cent by the year 2032. A once-off and permanent 5 per cent reduction in the property transfer duty rate in the ACT in 2020 (with revenue replaced via an increase in general rates) also increases real GSP in the ACT in 2032, but only by 0.022 per cent.

**Figure 3: Net state economic benefit indicators: small reduction in stamp duties in the ACT (orange line) versus complete removal of stamp duties in the ACT (blue line)**



## 4 Econometric methodology and results

Questions 3 and 4 involve quantifying the relationships between the ACT tax reforms and property turnover and property prices in the ACT. We address these points using econometric estimation. The technique we employ compares the changes in the tax regime in the ACT with observations of the property market.

The aspects of the tax reforms most relevant to the property market are the reductions in stamp duty on property transactions and the changes in general rates that broadly offset them. These changes apply across the whole of the ACT, which make it a challenge to separate the changes related to the tax reforms from other trends in the economy and the property market. Our solution is to use data from the property markets in NSW to control for the overall trends in the property market in and around the ACT.

We begin by outlining the model we use in our analysis, then describe the data we use to estimate the model, and finally present the results of the estimation.

### 4.1 Econometric model

In our econometric model, we assume a basic structure for the relationships between the policy change and each measure of the property market. Three types of outcomes are studied at the neighbourhood level in the ACT: the rate of turnover of the private properties in each year, an index of the (unimproved) private land values per square metre, and the mean price of private properties transacted. The equation we estimate is the following, in which  $p_{r,t}$  is the policy variable and  $\ln(y_{r,t})$  is the outcome specified in log terms:

$$\ln(y_{r,t}) = \alpha + \beta p_{r,t} + \gamma X_{r,t} + \delta_r + \varepsilon_{r,t}. \quad (4)$$

Equation (4) is fitted using ordinary least squares (OLS) regressions. Multiple versions are run for each outcome variable, using different specifications. This involves using two different measures of the stamp-duty reduction and different sets of controls. The control variables are intended to capture

all possible factors other than the policy variable that may correlate with both the policy variable and the outcome, which would bias our estimates of the coefficient  $\beta$  on the policy variable.

The subscript  $r$  indicates that the data are specific to neighbourhood  $r$ . We use the Australian Bureau of Statistics (ABS) definitions of ‘Statistical Areas’ at level 2, or simply ‘SA2’, as our neighbourhood definition. We also use the larger SA2 regions from the same ABS classification to create one of the controls. The subscript  $t$  denotes the financial year.

The variables in the estimation equation (4) are as follows:

- $y_{r,t}$  is either the number of property transactions, the land-value index, or the mean sale price for the properties transacted in SA2  $r$  in financial year  $t$ . We run each of these separately;
- $p_{r,t}$  represents the degree of implementation of the policy reforms;
- $X_{r,t}$  is a vector of optional controls, which can include log values of the rate of turnover and land-value index in neighbouring areas in NSW;
- $\alpha$ ,  $\beta$ , and  $\gamma$  are the coefficients we estimate. Note however that the coefficient we are mostly interested in is  $\beta$ , which represents the relationship between the policy change and the log value of the outcome;
- $\delta_r$  is a set of optional SA2-level fixed effects: a binary variable for each SA2  $r$  that takes value 1 if the observation is for that SA2. Effectively these are defined for all SA2s but one as there is already a constant in the regression;
- $\varepsilon_{r,t}$  is a set of independent and identically distributed random errors, which capture all other variation in the outcome variables.

The land-value index represents the changes in the value of existing properties. It is created by assigning a value of “1” in a given year (2016) and then calculating the values for all subsequent and previous years from the mean growth rates for each neighbourhood. The mean growth rate for a neighbourhood between two consecutive years is calculated from the total value of all properties that existed in the neighbourhood in both years.

The policy variable  $p_{r,t}$  is intended to represent the degree to which the policy reforms have been carried out. It is expressed as a proportional reduction in the rate of stamp duty, which is done to make the results simpler to interpret, as a positive coefficient means that a reduction in stamp duty is associated with a positive change in the outcome variable. The tax reforms also involve an increase in the general rates, to counterbalance the reduction in stamp duty revenue. The policy variable could instead have been expressed in terms of the general rates, the results for which we present in the appendix. It is shown to yield similar results for the rate of turnover, but somewhat different results for the land-value index and mean transaction price.

The policy variable is defined at the neighbourhood (SA2) level. It is calculated as the reduction in the rate of stamp duty in the neighbourhood: the reduction in total stamp duty revenue relative to the counterfactual situation in which the transaction prices were the same but the tax reforms had not been introduced. In the counterfactual situation, the rate of stamp duty would have remained unchanged from 2011-12 and the general rates would have been calculated using the same formula as in 2011-12.<sup>18</sup> Note that this does not mean the amount of stamp duty or general rates on a given property would have been constant since 2011-12, as the property values the stamp duty and general

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<sup>18</sup> The general rates are comprised of a fixed charge and a valuation charge, the former being applied independent of the property value and the latter being the average unimproved value (AUV) of the property multiplied by a rating factor that depends on the type of property. The fixed charges and rating factors are adjusted for each year after 2011-12 to achieve the anticipated target revenue for that year while maintaining a 50-50 split between the aggregate amounts levied from the fixed charges and valuation charges.

rates are applied to may have changed and the fixed charge and rating factors for general rates would have changed according to the pre-tax reform formula (as described in Footnote 17).

It is also worth noting that the results apply to the proportional changes in the rates of stamp duty and the corresponding general rates. Due to inflation in property values, the absolute amount of stamp duty paid on a property in a later period may be higher than the amount paid in an earlier period, even if the rate of stamp duty is lower. However, the results should be interpreted in terms of the proportional changes.

The region-level fixed effects  $\delta_r$  control for all factors that are constant for each neighbourhood over the period of the data but differ between neighbourhoods. For example, if the houses in a particular neighbourhood are more expensive than the average or if a certain neighbourhood has a more established population and thus tends to have a relatively low turnover, then these differences will be explained by the fixed effects. The advantage of using these fixed effects is that, if the levels are not controlled for, then the differences in levels between neighbourhoods may just happen to correlate with the outcome and thus bias the estimated coefficients.

Though it is common practice in this type of regression to also include fixed effects for the time period, in this context the financial year, we do not do this in our analysis. The reason is that the policy variable – the rate of stamp duty – barely varies between neighbourhoods in each period, so introducing a fixed effect for each financial year would capture practically all of the variation in the policy. The disadvantage of this approach is that not using time fixed effects means there are no controls for the overall changes in the economy and the property market, such as changes in the ease of borrowing money or an overall change in the type of housing owned and transacted in the ACT. To make up for this, we use controls for the property markets in parts of NSW that neighbour the ACT.

The controls we use for the property markets in NSW are the rate of turnover and a land-value index. These are intended to capture the dynamics of the property market in the broader region. As the changes to the ACT tax regime do not apply to properties in NSW, controlling for the dynamics of the property market in neighbouring places in NSW helps us to isolate the relationships with the ACT reforms, as it is reasonable to assume that any variation in the ACT not captured by the controls for the NSW market is due to the tax reforms. Due to place-specific factors and institutional differences, the property market in NSW is likely to differ somewhat from the market in the ACT, even in places within a short distance from the ACT border. However, the markets in the two jurisdictions are likely to be broadly subject to the same demand and supply factors.

The control variables for the NSW property market are defined as follows. The rate of turnover is simply the number of private property transactions divided by the number of private properties in the respective area. The land-value index for NSW is constructed in a similar way to the land-value index we use for the ACT. The rate of turnover is intended to reflect activity in parts of the broader property market not subject to the ACT tax regime, whereas the land-value index is intended to capture changes in the overall value of properties in that market. The index is used instead of a measure of the actual or improved property values because (a) we have more reliable data on it and (b) it avoids bias from changes in the types of properties that exist or are being constructed.

## 4.2 Data

Most of the data used in our econometric analysis are statistics on the property market in the ACT that were supplied directly to us by the ACT government. We complemented these with data from the NSW Valuer General and the ABS. The dataset we construct to run the analysis is aggregated by neighbourhood and by financial year.

The data on the ACT property market were supplied to us in three separate datasets, which we processed and combined to construct the dataset we used to run our analysis. The first dataset we received is of the locations of all properties in the ACT, coded by SSBU ('suburb', 'section', 'block', 'unit'). This information is used to identify the precise location of each property, which we used to convert the locations to the SA2s and to calculate the distance between each property and the NSW border.

The second dataset we received from the ACT government contains the annual property rates for each property and the unimproved property values that these rates are calculated based on. These data were provided for the 2008-09 to the 2018-19 financial years. We used the data on the unimproved property values to construct our index of land values for each SA2 in the ACT.

The third dataset from the ACT government details the property transactions in each year from 2004-05 to 2018-19, with the sale prices of the properties and stamp-duty payments. As the focus of the project is the private housing market, we use only the data on transactions of non-commercial properties. Some buyers are eligible for partial concessions on stamp duty and the data on payments are detailed gross and net of these concessions, in both the actual and counterfactual situations. As the net amounts of stamp duty are what is actually paid, we mostly apply the net amounts in our analysis. The data also show the effective changes in stamp duty rates explicitly, by detailing the actual amounts of stamp duty paid as well as the counterfactual rates that would have applied had the tax reforms not been introduced.

To control for trends in property markets, we complement the ACT data with data on the surrounding area from the NSW Valuer General. These were assembled from two datasets, one that details the unimproved value of each property by year and the other that lists all property transactions with the price of each transaction. We use the precise locations of the properties in NSW to calculate the distance of each property from the ACT border. We then use these distances to calculate variables for the number of properties, number of transactions, land value per square metre, and mean transaction price within various distances from the ACT border in each financial year.

We limit the dataset to the period from the 2008-09 to 2016-17 financial years. Beginning the dataset in 2008-09 is done to keep the data consistent, as this is the earliest year for which all variables are available. The raw data on property transactions exhibited a drop in the number of transactions in the last two financial years (2017-18 and 2018-19), in particular the most recent financial year. From our communication with the ACT government, we learned that this is likely due to the delayed registration of some properties in the database, in particular for properties transacted after the transition to barrier-free conveyancing in September 2017. Under the new regime, stamp duty is only paid on 'off-the-plan' and land-only properties when the transfer is completed, and property transactions are only included in the database when the stamp duty is paid. To avoid any bias that the artificial decline in the numbers of transactions and a selection of certain types of properties would cause, we use only data to the 2016-17 financial year.

### 4.3 Empirical results

Table 5 shows the results of the estimated relationship between the stamp-duty saving and the rate of property turnover in the local area. The outcome variable in this case is measured as the log proportion of the properties in SA2  $r$  that are transacted in year  $t$ .

**Table 5. Estimated relationship between the saving in stamp duty and the number of property transactions in the local SA2, where the dependent variable is  $\ln(\text{rate of property turnover in the SA2})^{19}$**

| Specification  | (1)                          | (2)                          | (3)                          | (4)                          | (5)                            | (6)                          | (7)                          | (8)                          | (9)                            | (10)                         |
|--|------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------|------------------------------|
| Stamp duty reduction (gross)                                       | 0.805 <sup>a</sup><br>(4.13) | N/A                          | 0.358 <sup>a</sup><br>(2.61) | N/A                          | N/A                            | N/A                          | N/A                          | N/A                          | N/A                            | N/A                          |
| Stamp duty reduction (net)   | N/A                          | 0.807 <sup>a</sup><br>(4.07) | N/A                          | 0.378 <sup>a</sup><br>(2.73) | -0.023<br>(-0.14)              | 0.382 <sup>c</sup><br>(1.81) | 0.926 <sup>a</sup><br>(4.29) | 0.806 <sup>a</sup><br>(4.13) | 0.608 <sup>b</sup><br>(2.54)   | 0.690 <sup>a</sup><br>(2.89) |
| $\ln(\text{rate of turnover in NSW } <10 \text{ km from the ACT})$ | N/A                          | N/A                          | N/A                          | N/A                          | -0.057 <sup>a</sup><br>(-2.87) | N/A                          | N/A                          | N/A                          | -0.040 <sup>b</sup><br>(-2.04) | N/A                          |
| $\ln(\text{rate of turnover in NSW } <50 \text{ km from the ACT})$ | N/A                          | N/A                          | N/A                          | N/A                          | N/A                            | 0.002<br>(0.03)              | N/A                          | N/A                          | N/A                            | -0.047<br>(-0.77)            |
| $\ln(\text{land-value index in NSW } <10 \text{ km from the ACT})$ | N/A                          | N/A                          | N/A                          | N/A                          | N/A                            | N/A                          | 0.208 <sup>a</sup><br>(4.70) | N/A                          | 0.194 <sup>a</sup><br>(4.44)   | N/A                          |
| $\ln(\text{land-value index in NSW } <50 \text{ km from the ACT})$ | N/A                          | N/A                          | N/A                          | N/A                          | N/A                            | N/A                          | N/A                          | 0.422 <sup>a</sup><br>(4.73) | N/A                            | 0.430 <sup>a</sup><br>(4.79) |
| SA2 fixed effects  | No                           | No                           | Yes                          | Yes                          | Yes                            | Yes                          | Yes                          | Yes                          | Yes                            | Yes                          |
| R squared  | 0.02                         | 0.02                         | 0.57                         | 0.57                         | 0.58                           | 0.57                         | 0.59                         | 0.59                         | 0.59                           | 0.59                         |

The first two regressions in Table 5 use only the stamp-duty saving and the error term on the right-hand side of (1). For the sake of comparison, versions of the regressions are run using stamp-duty *gross* and *net* of concessions. In each case the reduction in stamp duty is calculated by comparing the actual with the counterfactual amounts. We use the reduction in net stamp duty in the remainder of the regressions as it is the amount actually paid and thus better reflects the incentives people face. In any case, the savings in gross and net stamp duty yield similar coefficients.

Columns 3 and 4 of Table 5 introduce fixed effects for the SA2s. The coefficients on the stamp-duty saving are smaller in magnitude than in the absence of the SA2 fixed effects, suggesting that the coefficients in columns 1 and 2 are likely biased by spurious correlation between the policy and variation in the levels of transaction between SA2s.

The remaining columns in Table 5 add controls for the property market in parts of NSW that are near the ACT. We introduce the log rate of turnover in columns 5 and 6, then the log land-value index in columns 7 and 8, and columns 9 and 10 use both. Columns 5, 7, and 9 use these variables defined for the area within 10 kilometres of the ACT border and columns 6, 8, and 10 use these variables for the area within 50 kilometres of the ACT border. Our preferred specification uses both types of controls, as both are relevant to the outcome on the ACT property market. However, we have little basis for

<sup>19</sup> Note: 921 observations for each regression; *t*-statistics in parentheses; *a*, *b* and *c* indicate significant at 1%, 5% and 10%; N/A means the variable has not been included in the specification.

imposing a particular distance threshold. Thus we focus on the results in both columns 9 and 10 in Table 5. From the coefficients in these columns, the coefficient on the stamp-duty saving is estimated to be around 0.6.

The coefficients on the two controls for the property markets in NSW vary somewhat. However, the coefficient that we are primarily interested in – on the degree of the policy reform in the ACT – changes only slightly when a different distance threshold is used.

Though we have attempted to include all relevant controls we had access to, there is always the possibility of omitted variables. As explained above, an omitted variable that correlates with both the policy variable and the outcome could bias the results. The most important part of our technique in this respect is the controls for the property markets in NSW, which should capture a wide range of factors related to the property markets in and around the ACT.

To identify the relationship between the reduction in stamp duty and the land-value index, we estimate (1) with the land-value index in SA2  $r$  in financial year  $t$  on the left-hand side. The results are presented in Table 6. We use the same set of specifications and controls as in Table 5.

**Table 6. Estimated relationship between the saving in stamp duty and the land-value index in the SA2, where the dependent variable is  $\ln(\text{land-value index in the SA2})^{20}$**

| Specification  | (1)                           | (2)                           | (3)                           | (4)                           | (5)                           | (6)                            | (7)                             | (8)                             | (9)                             | (10)                            |
|--|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Stamp duty reduction (gross)                                       | 0.736 <sup>a</sup><br>(26.59) | N/A                           | 0.785 <sup>a</sup><br>(27.01) | N/A                           | N/A                           | N/A                            | N/A                             | N/A                             | N/A                             | N/A                             |
| Stamp duty reduction (net)   | N/A                           | 0.738 <sup>a</sup><br>(26.40) | N/A                           | 0.798 <sup>a</sup><br>(26.85) | 0.807 <sup>a</sup><br>(18.87) | 0.458 <sup>a</sup><br>(9.45)   | 0.302 <sup>a</sup><br>(14.82)   | 0.412 <sup>a</sup><br>(20.82)   | 0.178 <sup>a</sup><br>(6.28)    | 0.196 <sup>a</sup><br>(7.32)    |
| $\ln(\text{rate of turnover in NSW } <10 \text{ km from the ACT})$ | N/A                           | N/A                           | N/A                           | N/A                           | 0.001<br>(0.41)               | N/A                            | N/A                             | N/A                             | -0.016 <sup>a</sup><br>(-6.86)  | N/A                             |
| $\ln(\text{rate of turnover in NSW } <50 \text{ km from the ACT})$ | N/A                           | N/A                           | N/A                           | N/A                           | N/A                           | -0.130 <sup>a</sup><br>(-9.97) | N/A                             | N/A                             | N/A                             | -0.088 <sup>a</sup><br>(-11.62) |
| $\ln(\text{land-value index in NSW } <10 \text{ km from the ACT})$ | N/A                           | N/A                           | N/A                           | N/A                           | N/A                           | N/A                            | -0.188 <sup>a</sup><br>(-24.69) | N/A                             | -0.193 <sup>a</sup><br>(-25.53) | N/A                             |
| $\ln(\text{land-value index in NSW } <50 \text{ km from the ACT})$ | N/A                           | N/A                           | N/A                           | N/A                           | N/A                           | N/A                            | N/A                             | -0.380 <sup>a</sup><br>(-24.51) | N/A                             | -0.366 <sup>a</sup><br>(-24.62) |
| SA2 fixed effects  | No                            | No                            | Yes                           | Yes                           | Yes                           | Yes                            | Yes                             | Yes                             | Yes                             | Yes                             |
| R squared  | 0.430                         | 0.424                         | 0.537                         | 0.539                         | 0.539                         | 0.574                          | 0.746                           | 0.747                           | 0.752                           | 0.763                           |

<sup>20</sup> Note: 921 observations for each regression;  $t$ -statistics in parentheses;  $a$ ,  $b$  and  $c$  indicate significant at 1%, 5% and 10%; N/A means the variable has not been included in the specification.

The results in Table 6 show little difference between the specifications with reductions in gross and net stamp duty and the specifications with and without SA2 fixed effects. All coefficients on the reduction in stamp duty are positive and significantly different from zero. The controls for the property market in NSW reduce the magnitude of the coefficient. Again using the specifications in columns 9 and 10, the coefficient relating the reduction in stamp duty to the local land value is 0.2. However, in the appendix we run an alternative specification that uses the proportional increase in the general rates as the policy variable. The result is an insignificant relationship between the increase in general rates and the land-value index.

Table 7 shows the estimated coefficients for the relationship between the stamp-duty saving and the mean transaction price for the properties sold. Once again the estimation uses the same set of specifications as in Table 5.

**Table 7. Estimated relationship between the saving in stamp duty and the mean price of properties transacted in the SA2, where the dependent variable is ln(mean property transaction price in the SA2)<sup>21</sup>**

| Specification                                   | (1)                          | (2)                          | (3)                           | (4)                           | (5)                            | (6)                            | (7)                            | (8)                            | (9)                            | (10)                           |
|---|------------------------------|------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Stamp duty reduction (gross)                    | 0.189 <sup>a</sup><br>(2.66) | N/A                          | 0.613 <sup>a</sup><br>(15.77) | N/A                           | N/A                            | N/A                            | N/A                            | N/A                            | N/A                            | N/A                            |
| Stamp duty reduction (net)                      | N/A                          | 0.188 <sup>a</sup><br>(2.64) | N/A                           | 0.604 <sup>a</sup><br>(15.22) | 0.289 <sup>a</sup><br>(5.10)   | 0.164 <sup>b</sup><br>(2.16)   | 0.490 <sup>a</sup><br>(9.08)   | 0.531 <sup>a</sup><br>(10.89)  | 0.092<br>(1.18)                | 0.132<br>(1.63)                |
| ln(rate of turnover in NSW <10 km from the ACT) | N/A                          | N/A                          | N/A                           | N/A                           | -0.045 <sup>a</sup><br>(-6.59) | N/A                            | N/A                            | N/A                            | -0.050 <sup>a</sup><br>(-7.14) | N/A                            |
| ln(rate of turnover in NSW <50 km from the ACT) | N/A                          | N/A                          | N/A                           | N/A                           | N/A                            | -0.167 <sup>a</sup><br>(-6.14) | N/A                            | N/A                            | N/A                            | -0.162 <sup>a</sup><br>(-6.03) |
| ln(land-value index in NSW <10 km from the ACT) | N/A                          | N/A                          | N/A                           | N/A                           | N/A                            | N/A                            | -0.043 <sup>a</sup><br>(-3.01) | N/A                            | -0.061 <sup>a</sup><br>(-4.11) | N/A                            |
| ln(land-value index in NSW <50 km from the ACT) | N/A                          | N/A                          | N/A                           | N/A                           | N/A                            | N/A                            | N/A                            | -0.072 <sup>b</sup><br>(-2.54) | N/A                            | -0.045 <sup>c</sup><br>(-1.66) |
| SA2 fixed effects                               | No                           | No                           | Yes                           | Yes                           | Yes                            | Yes                            | Yes                            | Yes                            | Yes                            | Yes                            |
| R squared                                       | 0.00622                      | 0.00604                      | 0.784                         | 0.781                         | 0.791                          | 0.793                          | 0.783                          | 0.782                          | 0.795                          | 0.794                          |

The estimated coefficients on the policy variable in Table 7 vary widely in magnitude, though most are positive and significantly different from zero. The fixed effects and controls for the NSW

<sup>21</sup> Note: 921 observations for each regression; *t*-statistics in parentheses; *a*, *b* and *c* indicate significant at 1%, 5% and 10%; N/A means the variable has not been included in the specification.



property market change the magnitude of the coefficients but they remain significant. However, when both controls for the property market in neighbouring areas of NSW are used, the coefficients are no longer significantly different from zero. It is therefore not appropriate to conclude from this analysis that the real value of the coefficient is different from zero. Note that the alternative specification that uses the proportional increase in the general rates, presented in the appendix, produces a significant relationship between the increase in general rates and the land-value index.

#### 4.4 Discussion

The estimated coefficients are easier to understand if we convert them into more tangible figures. The coefficient for the relationship between the proportional reduction in (net) stamp duty and the number of non-commercial property transactions was estimated in Table 5 to be 0.6. This means that a reduction in stamp duty by a proportion of 10% (using the pre-reform rate as a base, so a reduction by 10% would reduce the rate from say 5% to 4.5%) would lead to a proportional increase in property sales of 6%.

The estimated coefficient from Table 6 for the relationship between the reduction in stamp duty and local land values is 0.2. This means that a proportional reduction in stamp duty by 10% would be associated with a 2% increase in the unimproved land value.

The coefficient for the relationship between the reduction in stamp duty and the mean transaction price of non-commercial properties was estimated in Table 7 to be insignificant. This means that we cannot infer a relationship between the variables from the empirical estimation, besides perhaps the lack of a strong positive or negative relationship. However, due to the positive relationship between the reform and unimproved land values exhibited in Table 6, it would make intuitive sense for the value of a given improved property to be moving in the same direction. This idea is also supported by the result in the appendix that using the alternative policy variable – the increase in general rates – produces a positive and significant relationship between the policy and improved property values.

There are three possible explanations for the lack of a positive and significant coefficient on the policy variable in Table 7: spurious variation in the measured improved property values that makes the statistical relationship less clear, changes in the composition of the housing stock that correlate negatively with the policy variable, or deterioration in the improved portions of property values as the unimproved values increase.

The first explanation essentially means that the underlying relationship does not show through as clearly because of some unusual observations or a small degree of random variation. This explanation is supported by the result in the appendix that using a variant of the policy variable produces a significant coefficient for mean transaction prices but not for the land-value index. Changes in the composition of the housing stock make it difficult to separate the changes associated with the policy from changes in the property market. For example, if there is a change in the composition of the housing stock such that more smaller properties are being sold in the ACT, such as apartments or townhouses, then this would bias downwards the coefficient on the stamp-duty reduction in Table 7 as relatively many small dwellings are being sold in years when the stamp-duty reductions are highest. Similar logic would apply if the improved portions of property values decrease when the unimproved values increase. The controls for the NSW property market are intended to capture such dynamics, but a bias could remain if the changes in the housing stock in the ACT differ from those in NSW. Changes in the composition of housing stock are a feasible explanation for the lack of a positive and significant coefficient on the policy variable in Table 7. The result being due to a deterioration in the improved portions of property values appears less likely.

An important caveat to the results is that the timing of property sales and even of construction projects may be adjusted in response to the policy. The schedule for the tax reforms was known about before their implementation began. This meant that any potential buyer or seller who would benefit by

delaying a property sale or purchase could choose to do so, which could lead to a positive bias in the estimated coefficients. To see this, consider a situation where the reduction in stamp duty makes it more attractive to buy and sell property. If buyers and sellers anticipate the reduction in stamp duty and can delay at little cost, then they may choose to wait and make the transaction when stamp duty is lower. This would reduce the sales before the reduction in stamp duty while increasing the sales after it, biasing the coefficient upwards. Moreover, it would be difficult to address this problem given the information available for this exercise. Naturally, the potential for this type of bias is greater the more agents in the market are able to plan their decisions in advance and to delay their transactions with little cost. However, as property prices have been growing quickly in the ACT – to the extent that the absolute amounts of stamp duty have often been increasing even when the rates were decreasing – it is unlikely that such delays would normally have been beneficial for buyers.

## 5 Conclusion

CoPS were commissioned to answer four questions concerning the impact of the ACT tax reform package. In a broad sense, three of the four questions were backward-looking, and asked whether the economic impact of the package (as implemented thus far) could be measured, and if there had been any measurable impact on housing turnover rates, and property prices. The final question was forward-looking: are there diminishing or increasing marginal benefits as tax reform proceeds?

A combination of Computable General Equilibrium (CGE) and econometric techniques were used to answer these four important questions. Using the VURMTAX bottom-up multi-regional CGE model of Australia's states and territories developed and maintained at CoPS, we ran a series of simulations to determine whether the ACT tax reform package had impacted the ACT economy in a measurable way, and whether there are diminishing or increasing marginal benefits from ongoing reform. In the first instance, we used a historical decomposition simulation over the period 2012 – 2018 to isolate and measure the impact of the ACT tax reform package. Our findings show that, *ceteris paribus*, the ACT tax reform package drove real GSP, real investment, real private consumption and real consumer wages in the ACT higher than they would otherwise have been by 2018.

We also showed that ongoing reform will likely bring with it decreasing marginal benefits in the long run. As we demonstrated via simulation in section 2.2, there are diminishing marginal benefits from ongoing reduction of property transfer duties rates in the ACT, while in contrast there are increasing marginal benefits of increased reliance on broad-based landowner taxation. These two effects compete with one another when property transfer duties are reduced and broad-based land taxes, like general rates in the ACT, are increased. Our analysis in section 3.2 shows that the two forces largely offset one another in the ACT. Moving forward, if the property transfer duty rate continues to fall the long-run gain in economic output (measured as the A\$m increase in ACT GSP) per dollar of property stamp duty revenue swapped, will likely exhibit a slight downward trend.

Our econometric analysis addresses how the tax reforms have affected the rate of turnover and the values of properties in the ACT. Expressed in terms of the proportional reduction in stamp duty, the effect of the policy on the rate of turnover has an estimated coefficient of 0.6. This means that a 10% reduction in the amount of stamp duty paid on the sale of each property is associated with a 6% increase in property sales. The estimated coefficient for unimproved land values is 0.2, meaning that a 10% reduction in stamp duty is associated with a 2% increase in land values. The coefficient we estimate for the mean transaction price is positive in magnitude but not significant, so it is not appropriate to infer a relationship between the reduction in stamp duty and the mean transaction price. However, in the appendix we show that if the corresponding increase in the general rates is used as the policy variable, the coefficient for the land value index is not significant while the coefficient for the mean transaction price is around 0.25, implying that a 10% increase in general rates is associated with a 2.5% increase in the mean transaction price. The results therefore suggest a degree of uncertainty about the magnitudes of the relationships, but it does appear that the policy is associated

with positive changes in both unimproved and improved property values. An additional caveat is that the mean transaction price will be influenced by the types of properties that are being transacted, which may bias the coefficient.

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## Appendix 1: Using general rates as a policy variable in the econometric estimation

To test the idea that the tax reforms can be captured by the single policy variable  $p_{r,t}$  calculated based on the reduction in stamp duty, Table 8 repeats the estimation with increases in the general rates to represent the policy. This is done by estimating (1) with the increase in general rates in place of the stamp-duty reduction and with both variables. As with the reduction in stamp duty, the increase in general rates is calculated in proportional terms relative to the counterfactual situation in which the 2011-12 tax regime still applied. For example, if the general rates due on a property were to go from 0.5% to 0.6%, then the variable reflecting the change in general rates would have a value of 0.2, reflecting a 20% proportional increase.

Table 8 presents the results for the rate of property turnover. Columns 1 and 4 of Table 8 repeat the results presented above using the stamp-duty reduction as the policy variable for the sake of comparison. Columns 2 and 5 use the increase in general rates in place of the stamp-duty reduction. Columns 3 and 6 use both policy variables.

Table 9 presents the equivalent results for the land-value index and

Table 10 presents the results for the mean price of properties transacted.

**Table 8. Estimated relationships between the policy variables and the rate of property turnover at the SA2 level where the dependent variable is  $\ln(\text{rate of property turnover in the SA2})^{22}$**

| Specification  | (1)                            | (2)                            | (3)                          | (4)                          | (5)                          | (6)                          |
|--|--------------------------------|--------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Stamp duty reduction (net)   | 0.608 <sup>b</sup><br>(2.54)   | N/A                            | 0.317<br>(1.27)              | 0.690 <sup>a</sup><br>(2.89) | N/A                          | 0.366<br>(1.46)              |
| General rates increase (net)                                       | N/A                            | 0.359 <sup>b</sup><br>(2.07)   | 0.186<br>(0.76)              | N/A                          | 0.448 <sup>a</sup><br>(2.70) | 0.237<br>(0.98)              |
| $\ln(\text{rate of turnover in NSW } <10 \text{ km from the ACT})$ | -0.040 <sup>b</sup><br>(-2.04) | -0.034 <sup>c</sup><br>(-1.76) | -0.026<br>(-1.33)            | N/A                          | N/A                          | N/A                          |
| $\ln(\text{rate of turnover in NSW } <50 \text{ km from the ACT})$ | N/A                            | N/A                            | N/A                          | -0.047<br>(-0.77)            | -0.040<br>(-0.68)            | -0.005<br>(-0.08)            |
| $\ln(\text{land-value index in NSW } <10 \text{ km from the ACT})$ | 0.194 <sup>a</sup><br>(4.44)   | 0.143 <sup>a</sup><br>(4.66)   | 0.162 <sup>a</sup><br>(5.00) | N/A                          | N/A                          | N/A                          |
| $\ln(\text{land-value index in NSW } <50 \text{ km from the ACT})$ | N/A                            | N/A                            | N/A                          | 0.430 <sup>a</sup><br>(4.79) | 0.322 <sup>a</sup><br>(5.02) | 0.348 <sup>a</sup><br>(5.22) |
| SA2 fixed effects  | Yes                            | Yes                            | Yes                          | Yes                          | Yes                          | Yes                          |
| R squared  | 0.588                          | 0.667                          | 0.667                        | 0.586                        | 0.665                        | 0.667                        |
| Number of observations   | 921                            | 877                            | 877                          | 921                          | 877                          | 877                          |

<sup>22</sup> Note:  $t$ -statistics in parentheses;  $a$ ,  $b$  and  $c$  indicate significant at 1%, 5% and 10%; N/A means the variable has not been included in the specification.

**Table 9. Estimated relationships between the policy variables and the land-value index at the SA2 level where the dependent variable is ln(land-value index in the SA2)<sup>23</sup>**

| Specification                                   | (1)                             | (2)                             | (3)                             | (4)                             | (5)                             | (6)                             |
|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Stamp duty reduction (net)                      | 0.178 <sup>a</sup><br>(6.28)    | N/A                             | 0.285 <sup>a</sup><br>(6.50)    | 0.196 <sup>a</sup><br>(7.32)    | N/A                             | 0.303 <sup>a</sup><br>(7.10)    |
| General rates increase (net)                    | N/A                             | -0.026<br>(-0.88)               | -0.182 <sup>a</sup><br>(-3.98)  | N/A                             | -0.004<br>(-0.12)               | -0.179 <sup>a</sup><br>(-3.99)  |
| ln(rate of turnover in NSW <10 km from the ACT) | -0.016 <sup>a</sup><br>(-6.86)  | -0.030 <sup>a</sup><br>(-12.54) | -0.022 <sup>a</sup><br>(-10.64) | N/A                             | N/A                             | N/A                             |
| ln(rate of turnover in NSW <50 km from the ACT) | N/A                             | N/A                             | N/A                             | -0.088 <sup>a</sup><br>(-11.62) | -0.141 <sup>a</sup><br>(-16.51) | -0.111 <sup>a</sup><br>(-15.76) |
| ln(land-value index in NSW <10 km from the ACT) | -0.193 <sup>a</sup><br>(-25.53) | -0.222 <sup>a</sup><br>(-28.36) | -0.205 <sup>a</sup><br>(-27.09) | N/A                             | N/A                             | N/A                             |
| ln(land-value index in NSW <50 km from the ACT) | N/A                             | N/A                             | N/A                             | -0.366 <sup>a</sup><br>(-24.62) | -0.400 <sup>a</sup><br>(-26.32) | -0.378 <sup>a</sup><br>(-25.75) |
| SA2 fixed effects                               | Yes                             | Yes                             | Yes                             | Yes                             | Yes                             | Yes                             |
| R squared                                       | 0.752                           | 0.764                           | 0.774                           | 0.763                           | 0.773                           | 0.785                           |
| Number of observations                          | 920                             | 877                             | 877                             | 920                             | 877                             | 877                             |

**Table 10. Estimated relationships between the policy variables and the mean property transaction price at the SA2 level where the dependent variable is ln(mean property transaction price in the SA2)<sup>24</sup>**

| Specification                                   | (1)                            | (2)                            | (3)                            | (4)                            | (5)                            | (6)                            |
|---|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Stamp duty reduction (net)                      | 0.092<br>(1.18)                | N/A                            | 0.130<br>(1.60)                | 0.132<br>(1.63)                | N/A                            | 0.160 <sup>c</sup><br>(1.94)   |
| General rates increase (net)                    | N/A                            | 0.232 <sup>a</sup><br>(3.78)   | 0.161 <sup>c</sup><br>(1.75)   | N/A                            | 0.271 <sup>a</sup><br>(4.52)   | 0.179 <sup>c</sup><br>(1.94)   |
| ln(rate of turnover in NSW <10 km from the ACT) | -0.050 <sup>a</sup><br>(-7.14) | -0.038 <sup>a</sup><br>(-7.33) | -0.034 <sup>a</sup><br>(-6.99) | N/A                            | N/A                            | N/A                            |
| ln(rate of turnover in NSW <50 km from the ACT) | N/A                            | N/A                            | N/A                            | -0.162 <sup>a</sup><br>(-6.03) | -0.117 <sup>a</sup><br>(-6.89) | -0.101 <sup>a</sup><br>(-6.22) |
| ln(land-value index in NSW <10 km from the ACT) | -0.061 <sup>a</sup><br>(-4.11) | -0.043 <sup>a</sup><br>(-4.63) | -0.035 <sup>a</sup><br>(-3.52) | N/A                            | N/A                            | N/A                            |
| ln(land-value index in NSW <50 km from the ACT) | N/A                            | N/A                            | N/A                            | -0.045 <sup>c</sup><br>(-1.66) | -0.036 <sup>c</sup><br>(-1.82) | -0.024<br>(-1.17)              |
| SA2 fixed effects                               | Yes                            | Yes                            | Yes                            | Yes                            | Yes                            | Yes                            |
| R squared                                       | 0.795                          | 0.875                          | 0.876                          | 0.794                          | 0.874                          | 0.874                          |
| Number of observations                          | 921                            | 877                            | 877                            | 921                            | 877                            | 877                            |

<sup>23</sup> Note: *t*-statistics in parentheses; *a*, *b* and *c* indicate significant at 1%, 5% and 10%; N/A means the variable has not been included in the specification.

<sup>24</sup> Note: *t*-statistics in parentheses; *a*, *b* and *c* indicate significant at 1%, 5% and 10%; N/A means the variable has not been included in the specification.

The estimated coefficients on the proportional increase in general rates in Table 8 are positive and significant. This is in line with the results for the stamp-duty reduction, as a positive coefficient on either variable reflect the tax reforms having a positive effect on the rate of property turnover. The coefficients on the increase in general rates are smaller in magnitude than the coefficients on the reduction in stamp duty, but broadly consistent.

When both the stamp-duty reduction and general-rates increase are included in Table 8, the coefficients on both variables are insignificant. This is likely because of multicollinearity: when two independent variables are strongly correlated, their individual coefficients are generally unreliable. The reduction in stamp duty and the increase in general rates have a correlation of 0.77. As each variable partly captures the variation in the other, the coefficients on them may become weaker, as appears to be the case here. The larger problem is that small random changes in the data can lead to wildly different values of the coefficients, which does not appear to be the case here. Nonetheless, the regressions with one policy variable are more reliable.

The results for the land-value index in the

Table 9 are somewhat different. The coefficient on the increase in general rates is not significant with either set of controls for the NSW property market. When both policy variables are used, the coefficient on the reduction in stamp duty becomes larger in magnitude while the coefficient on the increase in general rates is negative. The results in

Table 10 show that for the mean transaction price, the coefficients on the increase in general rates are positive and significant while the coefficients on the reduction in stamp duty are generally not significant. The results for the land-value index and mean transaction price therefore mirror one another, with one policy variable being significant in each case. This could be because of the functional forms of the relationships between the policy variables and the two outcomes, which when fitted with linear functions may not yield positive coefficients even if the underlying relationships are indeed positive.